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THE

PRINCIPLES AND PRACTICE

OF

OPHTHALMIC SURGERY.

G. WOODFALL, ANGEL COURT, SKINNER ST.

THE

PRINCIPLES AND PRACTICE

OF

OPHTHALMIC SURGERY.

COMPRISING

The Anatomy, Physiology, and Pathology

OF

THE EYE,

WITH THE TREATMENT OF ITS DISEASES.

BY

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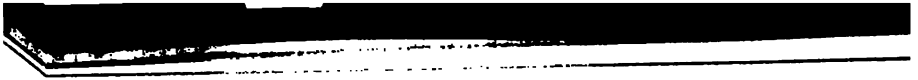

BIBLIOTHECA · BODLEIANA

TO

RICHARD D. GRAINGER, ESQ.,

LECTURER ON ANATOMY AND PHYSIOLOGY AT THE THEATRE OF ANATOMY AND MEDICINE, WEBB STREET, MAZE POND,

THIS LITTLE BOOK

IS MOST RESPECTFULLY INSCRIBED,

AS A TRIFLING ACKNOWLEDGMENT FOR THE MANY ACTS OF KINDNESS AND REGARD

WHICH HAVE BEEN CONFERRED

ON HIS OBEDIENT SERVANT,

A. C. LEE.

PREFACE.

WHOEVER ventures to add a new book to the stock already in existence, is bound to show good and sufficient cause for such an addition. In the present instance, having no pretension to originality of matter, my sole aim has been to present to the reader, in what I conceived to be the most convenient form, every point of importance connected with the subject under consideration.

The book consists of Two Parts: the first of which embraces the Anatomy and Physiology of the Eye; while the second is devoted exclusively to its Diseases, and their Treatment. To apologize for the introduction of a description of the structure and physiology of the Eye, into this book, will, I imagine, be needless. To those who are sticklers for precedent, the excellent work of Mr. Travers will suffice; but were no such example in existence, I should still hazard its introduction, as I consider that an examination of its structure and physiology ought to go hand in hand with the investigation of its diseases; and he who is thoroughly conversant with its anatomical structure, will be able to treat the various affections of its tissues on the same general principles which guide him in the treatment of similar affections in *other* parts of the body.

in the manner which seemed best c
clear and connected account of the S
siology of the Eye.

The Second Part, which is devoted
Pathology and Treatment of Disease
for its basis some very clear and concis
delivered by Mr. Green, at St. Thomas
subject in question, and which convey
formation in a very small compass.
has been somewhat modified, and ad
made from the works of Lawrence, T
rie, where any deficiency was observed.

The sources from whence I have dra
for this book are the works of Messrs. T
Mayo, Müller, Brewster, Lawrence, G
rie.

Such is a sketch of the contents of
which is offered to the notice of the P
from a desire to place within the reach
of studying the structure, functions, an

original work, from the conviction, that he, who facilitates the approach to the fountain of knowledge, who communicates that to the *many* which before was only known to the *few*, is entitled to almost as large a share of praise as he who adds fresh links to the chain of human knowledge.

A. C. L.

Three Crown Square, Southwark.
October 20th, 1838.

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AN

ANATOMICAL DESCRIPTION

OF

THE EYE

AND ITS APPENDAGES.

THE eyes, or organs of vision, are contained in two somewhat irregular funnel-shaped or pyramidal cavities, situated on either side of the root of the nose, and immediately under the arch of the forehead.

ORBITS.

These cavities are denominated the *Orbits:* which have their apices looking backwards and inwards, and their bases outwards and forwards. The axes of the two orbits are, consequently, oblique lines, which posteriorly converge, and decussate about the sella turcica, anteriorly, on the contrary, they diverge; an arrangement by which the field of vision is greatly extended.

Their Parietes.

The walls of each orbit are formed by seven bones; namely, the frontal, the sphenoid, æthmoid, lachrymal, maxillary, palate, and malar bones. The upper wall or roof of the orbit, *which is* formed by the orbital plate of the

is formed by the malar, superior maxillary bones; the infra-orbital canal extends alc surface, transmitting vessels, which freel with the ophthalmic, and a nerve from v ferior palpebra derives its chief supply. T temporal wall is formed by the malar and sp and diverges considerably. The internal is formed by the lachrymal, æthmoid, sphe late bones; it is plane and nearly parallel v of the opposite side. Anteriorly, the base formed by the frontal, the malar, and supe bones.

Their Foramina.

The foramina opening into this cavity Anteriorly in the base of the orbit there the *supra-orbital*, for the transmission o bital or frontal nerve; the *infra-orbital*, fo sion of vessels, and a nerve from which t palpebra derives its chief supply; the *malar*,

mic vein; the *spheno-maxillary fissure*, for the passa of the spheno maxillary nerve; and two *internal orbit foramina* in the suture connecting the frontal and æthmoid bones, for the transmission of vessels and nerves the anterior one transmitting the nasal division of the ophthalmic nerve.

Contents of the Orbit.

The contents of the orbit are the eye and its appendages, imbedded in a quantity of adipose substance. These appendages may, for convenience of description, be further divided into *orbital appendages*, which are situated posterior to the cornea; and *facial appendages*, which are placed anterior to the cornea.

FACIAL APPENDAGES.

THE SUPERCILIUM, OR EYEBROW.

The arch of the eyebrow corresponds to that of the superciliary ridge upon which it is planted. It extends from the tuberosity of the frontal sinus to the external angle of the orbit. It consists of a thick row of strong short hairs, which have a disposition almost erect at the commencement of the brow, and are then arched obliquely outward, and gradually reduced in number so as to terminate the arch acutely. The few erect hairs correspond to the fibres of the corrugator supercilii muscle, the crescentic to the fibres of the orbicularis palpebrarum.

The extent and fulness of the brows vary greatly in different persons. In some, especially persons of dark complexion and black hair, they have little, if any, inter-

the orbicular muscle of the palpebra. T
vates the brow, wrinkling the integume
head horizontally; the latter depresses it,
eyelids, being the sphincter palpebrarum.

The *corrugatores* approximate the head
cilia, drawing the integuments over the r
into deep longitudinal rugæ: they coop
orbicularis in the act of frowning. The
subjacent muscles renders the brow an
ture in regulating the quantity of light, c
field of vision, and in assisting the exp
sterner passions. It would not be a usele
it were insusceptible of motion, the hair
tageously placed upon the projecting ridg
to entangle and arrest particles, solid an
might otherwise fall or trickle upon t
habitual depression of the brow is usual
tant of a weak or morbid retina; it is ch
strumous inflammation, and is observab
where light is offensive, and in those ce

the light falling upon the eye by the degree of their separation, or exclude it by their apposition. They consist of the *skin* externally, the *conjunctiva* membrane internally, and between the two are placed the *orbicular muscle*, *tarsal cartilage*, and *Meibomian follicles*; and lastly, along the free edge of each there are a row of hairs, which are denominated *ciliæ*, or *eyelashes*: in the superior there is also the expansion of the levator palpebræ muscle. The skin covering the palpebræ is thin, and loosely connected to the subjacent parts by a fine lax cellular texture, which abounds at the orbitar margins of the palpebræ. The frequent œdema of the eyelids, so disfiguring to the countenance, is owing to the abundance of this tissue void of fat, and subject therefore to serous infiltration.

Orbicularis Muscle.

On removing the skin and the subjacent cellular tissue of the palpebræ, the thinly spread fibres of the *orbicularis muscle* may be observed; broad, thin, and somewhat oval, in some subjects very pale and indistinct, in others strong and well marked; it *arises* from the internal angular process of the temporal bone, and from a tendon at the inner angle of the eye, by a number of fleshy fibres which pass round the orbit, covering first the superior and then the inferior eyelid, and also the bony edges of the orbit: it is *inserted* by a short round tendon into the nasal process of the superior maxillary bone. This muscle is covered by and adheres to the skin; superiorly it intermixes with the occipito frontalis, and covers the corrugator supercilii, the frontal vessels and nerves, the tar-

rbital fibres of this muscle are strong and red
ircularly round the base of the orbit; the
alpebral fibres are pale, thin, and scattered
ontained in the eyelids; the internal or cilia
s a thick but pale fasciculus, situated under
t the edge of each eyelid. The palpebral
ortions adhere more closely to the skin, and
lliptical appearance, as the fibres from the
ower eyelid intersect each other at the outer
nd adhere to the ligament of the external c
The horizontal tendon of this muscle passes
achrymal sac, a little above its centre, and
poneurosis, derived from its upper and lo
overs all the anterior surface of the sac, and
he margins of the bony gutter, in which i
This tendon can be seen or felt through the in
luring life, particularly when the muscle is in
when the eyelids are drawn towards the te
he operation of opening the lachrymal sac, t
hould commence immediately below this te

formed between the *tarsi* and the tendon of the *orbicularis* muscle.

TARSAL CARTILAGES.

The *tarsi* are two elliptical, elastic plates of cartilage, which give firmness and figure to the palpebræ, and afford a basis for the attachment of their several parts. The superior is semi-lunar and larger than the inferior, which is long and narrow. Their ciliary margins are thick: their orbital margins thin, and connected to the orbit by the palpebral ligaments, which are a continuation of the periosteum; these ligaments are stronger towards the temple, where they decussate and attach the cartilages at their external canthus or commissure; the tendo oculi fixes them internally. Their temporal extremities are angular, their nasal rounded. The convex surface of the tarsi is covered by the fibres of the orbicularis and the cellular membrane, connecting them with the integument; the concave, which is exactly moulded to the surface of the globe, is covered by the conjunctiva membrane.

EYELASHES.

The exterior borders of the sloped edges of the tarsi, which are opposed to each other, are furnished with *cilia*, or *eyelashes*, disposed in three or four rows; these we may therefore call the ciliary borders of the tarsi. The apertures in which their bulbs are contained, are seen in the integument when the cilia are extracted; they are more numerous and longer upon the centre than the extremities *of the* tarsal arch, and fewer and shorter on the

lower than the upper tarsus. Their direction is curved, those from the upper being arched upwards, from the lower downwards. The length and fulness of the eyelashes vary in different individuals. They are commonly of the same colour as the eyebrows.

FOLLICLES OF MEIBOMIUS.

Upon the interior border of the tarsus the mouths of a row of follicles, seated vertically on the concave surface of the tarsus, form a slightly eminent line. These follicles are of a white or yellow colour, are arranged in nearly parallel vertical rows, and are more numerous in the upper than the lower eyelid; when magnified, they appear to be small knotted tubes, resembling studs of the smallest pearls, arranged for the most part in parallel lines, and communicating with each other at their origin from the orbitar edges of the tarsi, but terminating by distinct orifices upon their interior borders, which we may distinguish from the ciliary as the Meibomian borders of the tarsi. In their length, connexion, and arrangement, they present considerable variety. The fluid they secrete in health is thin and sebaceous, lubricating the tarsal edges, preventing the effects of attrition from their frequent contact, and facilitating their motions over the contiguous surface of the globe. In diseased states of the follicles, this fluid may be secreted in a condensed form, or after death in the shape of small white worms.

PUNCTA LACRYMALIA.

The obliquity of the tarsal edges, which are opposed to

each other, leaves a groove, or sulcus, between the M bomian borders and the surface of the globe, when t ciliary borders are in contact. This increases in breadt toward the nasal angles of the tarsi, where the *puncta* or orifices of the lachrymal excretories, are placed upo two small eminences accurately opposed, and terminating the Meibomian borders; they are two pinholes formed in the cartilaginous substance, and thus preserved permanently open.

LACHRYMAL DUCTS.

The *lachrymal ducts* extend from the puncta to the lachrymal sac; the superior is longer and more curved than the inferior; the former is concave inferiorly; the latter is nearly straight, a little concave upwards; they both open into the external part of the sac, a little above its middle, sometimes by one, and sometimes by distinct orifices, behind the *tendo oculi;* each duct is surrounded by a process of that tendon, and lined by mucous membrane.

LACHRYMAL SAC.

The *lachrymal sac* is a small oval pouch of mucous membrane, closed above, and leading below into the nasal duct; it is situated in a fossa formed by the anterior cave portion of the os unguis, and the nasal process he superior maxillary bone on which it rests; in front s covered by the skin, the tendo oculi, some fleshy s of the orbicularis, and a strong fascia which is de- l from the tendon, and connected to the surrounding margin. On its outer side there is an opening for

sac, and directing the ducts and their conte
it; it is not, however, in all subjects, to be di
from the orbicular, which last can effect the
cribed to this small muscle.

NASAL DUCT.

The *nasal duct*, which is the continuation
chrymal sac, and is about three-fourths of
length in the recent state, descends obliquely
and a little outwards, surrounded by the ma
guis, and inferior spongy bones; beneath t
opens by a small slit-like orifice, which is sur
a circular fold of mucous membrane, into the
tus, about an inch from the anterior part of
this duct is formed of mucous membrane only
nected to the periosteum.

The puncta absorb the tears, which hav
ducted by the tarsi from the lachrymal duct
vey them into the sac, to pass off by the nasal

the common mucous membrane of the nostrils, fauces, and alimentary canal.

The conjunctiva, having lined the interior surfaces of the tarsi, is connected to the ligaments of the tarsi and palpebral muscles, and thence reflected on the globe of the eye, so as to form an oblong sac or pouch. Its attachment to the sclerotic is such as to prevent its forming folds in the motions of the globe, to the freedom of which it offers no impediment. As it approaches the cornea, its attachment becomes more strict, and at the margin of that membrane it is inseparable from it. Its continuity is ascertained by dissection, but its tenuity and transparency are increased, and when held to the light it has a nearer resemblance to a very delicate lamella of the cornea than to the conjunctiva of the sclerotic. After maceration, the separation is more readily effected.

Its continuity demonstrated by Disease.

The character of this membrane is so materially modified by its several relations with the integument, the tarsi, the sclerotic, and the cornea, that its continuity alone establishes its identity. The fact of this continuity is, however, corroborated by some pathological phenomena, which so often illustrate problematical points in anatomy and physiology. For example, the conjunctiva furnishes the matrix for the adventitious vessels, which are created to repair breaches of the corneal texture. These vessels, whether formed by the healing process, or opened by long continued diseased action, as in chronic ophthalmia, are obviously superficial. The circumstances by which they are produced, are characterized by

:tly depicted by the margin of the abrasure
ntrast of the surfaces. This is very dissimil
iterstitial ulcer of the cornea. The pterygiu
isease, exhibits the continuity in a very stril
er. It has a full broad base next the canth
ie conjunctiva lies loose, and is gradually flat
rawn to a point, so as to have a wedge-like
pproaches the cornea. But although the de
eneath the conjunctiva, it does not stop at t
ut slowly travels across it. The strictness of th
lters its appearance; the lymph, shed betwe
unctiva and cornea, presenting only a progre
pacity, instead of the fleshy elevation which
ipon the sclerotic. The continuity of the
exture is demonstrable.

Upon the tarsi the membrane is closely adh
lthough transparent, appears of a pale red
he sclerotic and cornea it is colourless. Th
onjunctiva, however destitute of red vessels i
quil state of the organ, becomes conspicuou

vessels freely inosculating from its opposite sides, and anastomosing with each other. The increase in number and extent of these vessels is a gradual process, demonstrable to observation; and the inflammatory action which precedes this state is ordinarily of considerable duration. The incapacity of the vessels of the corneal conjunctiva to receive red blood, seems to depend upon the strictness of its adhesion.

Valvula Semilunaris.

The conjunctiva is attached to the canthi of the eyelids, and, at the internal canthus, forms a semi-lunar duplicature in the shape of a valve. The horns of this crescentic fold are lost in the sinus palpebralis, or angular fold of the conjunctiva.

Caruncula Lachrymalis.

On the fore part of this valve, a small red glandular body, *caruncula lachrymalis*, is seen, occupying the hollow of the canthus. The caruncula is a granulated substance, of a conical form and a deep red colour. The base of the cone is next the orbit, the apex towards the eye. A few fine hairs are scattered over its surface. It is made up of a congeries of minute follicles, secreting that mucus which accumulates during sleep in the form of a gummy matter, at the inner corner of the eye; and appears to perform a similar office to that of the Meibomian glands, which are confined to the tarsi.

From the above description it will be understood, that the palpebræ, the anterior hemisphere of the eyeball, and the lachrymal passages, are every where covered by a

faces, healthy and morbid, remote and cont
that the diseases with which they are affect
the most part a common character.

VESSELS OF THE EYELIDS.

A superior and inferior branch, derived fro
thalmic artery, at its egress from the orbit, c
the orbital edges of the tarsi, and form by inc
the external angle, a complete *arcus palpebr*
perciliary arch is also formed by the union o
ciliary artery, from the ophthalmic, with th
The nasal branch of the facial artery assists
these arches, and freely communicates with
branch of the ophthalmic. The superior coro
verse facial, infra-orbital and temporal artery
in the supply of the palpebræ.

The VEINS, beginning by small radicles fi
posite margins of the tarsi, form an intricat
neath the skin of the palpebræ, and are colle
facial, supra-orbital, and deep temporal vein.

frontal branch of the fifth pair supplies the superciliary and superior palpebral branches; and the infra-orbital, or first branch of the superior maxillary nerve, gives off three principal branches, which turn round the trunk of the facial vein, to be dispersed upon the lower eyelid.

PECULIARITIES OF THE UPPER AND LOWER EYELIDS.

Thus far, the anatomical structure of the eyelids has been generally described; there remain some peculiarities which are now to be examined. The superior is broader than the inferior palpebra, covering two-thirds of the surface of the globe by its descent. It is also more moveable, the inferior palpebra being inconsiderably elevated to meet it in shutting the eye. The superior palpebra, when drawn up, makes a doubling or deep crescent-shaped fold in the skin under the orbitar arch, which is effaced when the palpebra falls. Upon the skin of the lower eyelid narrow and gently curved rugæ are seen; these, which are signs of the unequal contractility of the skin and the muscular fibres beneath it, are more strongly marked in persons of advanced years, in whom the muscles have been longer and more rigorously employed, and whose skin is loose or redundant from the absorption of the adeps beneath it.

The parts next in order that we have to examine are the

ORBITAR APPENDAGES.

PERIOSTEUM.

The walls of the orbit are lined by a process of the

dura mater, which, passing out of the cranial cavity, gives a periosteal covering to the bones of the orbit, and becomes continuous at all its openings with the periosteum of the head and face; hence the extensive sympathetic pains in inflammatory affections of the bones of the face and cranium, and their common membrane. Hence also probably the suppurative inflammation of the dura mater, after extensive fractures and injuries of the orbit.

FAT.

The fat, which in health is secreted abundantly in the orbit, surrounds the optic nerve, and invests the posterior surface and sides of the globe, forming for it a soft bed, and defending the vessels and nerves from compression in its motions. In emaciating diseases its diminution by absorption produces that characteristic sinking of the globe in its socket, and loss of convexity in the eyelid, which is familiarly expressed by the term "hollow-eyed." On the other hand, its secretion in excess, as in morbid obesity, protrudes, compresses, and thus induces congestion in the vessels of the eye.

The muscles of the orbit are seven in number; viz., the levator palpebræ; the rectus superior, inferior, internus, and externus; obliquus superior and inferior.

LEVATOR PALPEBRÆ.

The levator palpebræ is the highest muscle in the orbit; it *arises* narrow and tendinous from the upper edge of the foramen opticum, passes forwards and outwards beneath the frontal nerve, and becoming broader, bends down in *front of the eye*; it then ends in a dense cellular expan-

sion, which is *inserted* into the superior border of the tarsal cartilage and into the superior palpebral sinus of the conjunctiva, behind the palpebral ligament. *Use*, to elevate and retract into the orbit the upper eyelid. From the nature and extent of its connection with the eyelid, it results that the partial division of the tarsal ligament, or even the removal of the cartilage, does not take away the power of elevating the lid, as the paralysis of this muscle does; the elevation, however, under these circumstances, is imperfectly performed.

The *recti* muscles are four in number; the *superior* or *attollens oculi*, the *inferior* or *depressor oculi*, the *internal* or *adductor oculi*, and the *external* or *abductor oculi*.

RECTUS SUPERIOR.

The *rectus superior* is broad, thin, and tendinous at its extremities, and fleshy in the rest of its extent; *arising* from the border of the foramen opticum and the partition between it and the foramen lacerum; inserted into the sclerotic, about a quarter of an inch behind the cornea. The *superior* surface of this muscle is covered by the elevator palpebræ; the *inferior* is placed upon the optic nerve, the ophthalmic artery, and the nasal branch of the ophthalmic nerve, anteriorly upon the eye itself. This muscle raises the eye.

RECTUS INFERIOR.

The *rectus inferior*, similar in structure and figure to the preceding, *arises* from a ligament which in part surrounds the foramen opticum, and fills up the foramen

the eye downwards, and consequently it is a
to the *superior*.

RECTUS INTERNUS.

The *rectus internus* is similar in its figure
the preceding, and is inserted, on the inne
eye, into the sclerotic. The action of this
draw the eye towards the nose.

RECTUS EXTERNUS.

The *rectus externus* arises by two distinc
inferior having a common origin with the *re*
and *inferior*, from the ligament which occupie
angle of the foramen lacerum; the *superior*
of ligament crossing the foramen above. I
into the outer part of the sclerotic coat. It
roll the globe of the eye outwards. It is
note this bicipital origin of the rectus externu
the nerves of the orbit pass through the i
tween its heads, and others through the top

port to the external, inferior, and internal recti muscles, in the manner of the intermuscular ligaments of the extremities.

ACTIONS OF THE RECTI.

The single actions of the *recti* are expressed by the terms, levator, depressor, adductor, abductor. Their co-operation retracts the globe in its socket.

SUPERIOR OBLIQUE.

The *superior oblique* muscle, situated at the upper and inner part of the orbit, *arises* at the upper and inner border of the foramen opticum, whence it proceeds forward along the os planum, and ends in a slender round tendon, which passes through a half ring of cartilage that is attached by a ligament to the os frontis, a little above and behind its internal angular process. This *trochlea* is provided with a sacculus mucosus, and the tendon emerging from it is enclosed in a ligamentous sheath; this tendon is then reflected backwards, outwards, and downwards, between the superior rectus and the eye, and then becoming broad and thin, is *inserted* into the sclerotic coat between the superior and external recti; about midway between the entrance of the optic nerve and the insertion of the superior rectus. The *action* of this muscle is to draw the eye forwards and inwards, also to rotate it, so as to direct the cornea downwards and inwards towards the tip of the nose. Some authors consider it a rotator outwards.

INFERIOR OBLIQUE.

The *inferior oblique*, situated at the inferior and an-

) the sclerotic coat behind the transverse axis of
, and between the sclerotic coat and the external
. Its action is to draw the globe forwards and inwa
l to rotate it upwards and outwards. The two ob
scles acting together draw the eye forwards and
rds, consequently they are antagonists to the recti

ARTERIES OF THE ORBIT.

The ARTERIES of the eye are principally derived
e ophthalmic artery, which *arises* from the interna
id, close to the anterior clinoid process, passes forw
rough the optic foramen, below the optic nerve an
nal to it; in the orbit it rises above this nerve
ines round it to the inner side of this cavity, t
ich it passes to the inner canthus, where it termin
ne branches it gives off in its course are, while o
ter side of the nerve,—

1st. *Centralis retinæ*, very small, it pierces the she
the optic nerve, passes along the centre of the
into the eye, where it divides into delicate ram

The branches given off by the ophthalmic artery above the optic nerve, are,—

3d. The *supra-orbital*, which passes forward along the levator palpebræ, and through the superciliary notch, supplies the muscles and integuments of the eyebrow, and ascending on the forehead divides into several branches, which are distributed to the scalp, and communicate with the temporal and occipital arteries.

4th. The *posterior ciliary*, ten or twelve in number, are very small, they surround the optic nerve, and pierce the back part of the sclerotic; pass between it and the choroid, and are distributed to the latter; some of their branches continue as far as the ciliary processes and the iris.

5th. *Long ciliary*, one on each side; they pass horizontally forwards, between the sclerotic and choroid membranes, as far as the ciliary circle; here they divide, and form a circular inosculation round the circumference of the iris; from this several branches radiate inwards, and again unite in a circle near the pupil.

6th. *Muscular arteries*, to the different muscles in the orbit.

The branches given off by the ophthalmic artery in its course along the inside of the optic nerve, are,—

7th. *Ethmoidal arteries*, they pass through the posterior orbitar foramen to the mucous membrane in the æthmoid cells.

8th. *Superior* and *inferior palpebral* arteries to the palpebræ, caruncula, conjunctiva, and lachrymal sac.

The veins of the orbit correspond t
are all collected into the ophthalmic v
through the orbit. It takes a serpenti
optic nerve, through the foramen lace
in the anterior part of the cavernous
mater.

The NERVES of the orbit are the *opti*
pair or *motores oculorum;* the fourth,
ophthalmic division of the fifth; and t
centes.

OPTIC NERVE.

Each optic nerve, on passing through
becomes surrounded by a strong sheath
dura mater; the four recti muscles next
the fleshy portions of which it is separa
able quantity of soft fat, in which se
vessels are lodged; from the optic fo
proceeds forwards and a little inwards.

substance is contained, so that this nerve is not composed like other nerves, of several filaments placed parallel to each other; if the white substance be removed by maceration in an alkali, its cellular structure will become obvious.

SITUATION OF THE NERVES IN THE CAVERNOUS SINUS.

In the cavernous sinus at the side of the body of the sphenoid bone, the four nerves of the orbit are arranged in their numerical order, viz. most superiorly the third pair, then the fourth, next the ophthalmic division of the fifth pair, and most inferiorly the sixth or abducens nerve; in this part of their course, they are so closely united together, that they are sometimes called the *orbitar plexus;* when, however, they arrive at the anterior clinoid process, they separate, and as they enter the foramen lacerum orbitale, their arrangement is as follows; most superiorly the *fourth*, then the *frontal* branch of the ophthalmic, next the superior division of the third, external to which, and near to the outer wall of the orbit is the *lachrymal* branch of the ophthalmic, after these the *nasal* nerve, below which is the *inferior division* of the *third*, and lastly, lying inferior to them all is the *sixth*, holding the same relation to them as at the cavernous sinus.

THIRD PAIR.

The *third pair* enter the orbit in company with the nasal branch of the fifth and the sixth pair, and divides into two branches. Its *superior* or *lesser* branch divides into two branches, the smaller and shorter one of which

optic nerve, and getting to its internal side is
so the internal rectus; the *middle* supplies t
rectus; and the *external*, which is the long
downwards and forwards on the surface of t
rectus, between it and the globe of the eye, (it
filaments to this muscle,) and is lost in the infe
muscle; besides these branches the *inferior di*
third pair gives off from its root a small short
the ophthalmic ganglion. All the branches
pair are distributed to the *ocular* surface of th

FOURTH PAIR.

The *fourth pair*, called also *trochleator* or
enters the orbit by the foramen lacerum, ascer
forwards and inwards above the levator palpe
superior rectus, and is distributed by four
branches to the upper surface of the supe
muscle: as this delicate nerve is passing alor
side of the cavernous sinus, it lies between tl
and the ophthalmic branch of the fifth, belov

OPHTHALMIC DIVISION OF THE FIFTH PAIR OF NERVES.

The *fifth pair*, or *trigemini*, having formed the semilunar or gasserian ganglion, divides into three branches; the *ophthalmic*, the *superior* and *inferior maxillary* nerves.

The ophthalmic nerve passes along the outer side of the cavernous sinus below the third and fourth, and above the sixth, in this situation it receives some filaments from the sympathetic nerve; as it approaches the foramen lacerum orbitale, it divides into three branches, the *lachrymal*, *frontal*, and *nasal*.

Lachrymal Nerve.

The *lachrymal nerve*, the smallest of the three, passes forwards and outwards to the lachrymal gland, above the external rectus muscle and beneath the periosteum; in this course it is surrounded by fat and accompanied by the lachrymal artery; it gives off two small branches, one through the spheno maxillary fissure to communicate with the superior maxillary nerve, and the other through the malar bone, to communicate with the facial nerve; it then enlarges, sends four or five branches to the inferior surface of the lachrymal gland, and terminates in several fine soft filaments on the conjunctiva lining the superior palpebra, and the cellular membrane between the gland and malar bone.

Frontal Nerve.

The *frontal nerve* enters the orbit between the superior rectus and the periosteum, along with the fourth, but inferior and external to it; it passes forwards in a kind of

probably the suppurative inflammation of the d
after extensive fractures and injuries of the orl

FAT.

The fat, which in health is secreted abunda
orbit, surrounds the optic nerve, and invests th
surface and sides of the globe, forming for it a
and defending the vessels and nerves from o
in its motions. In emaciating diseases its dim
absorption produces that characteristic sinki
globe in its socket, and loss of convexity in t
which is familiarly expressed by the term "hol
On the other hand, its secretion in excess, as
obesity, protrudes, compresses, and thus induc
tion in the vessels of the eye.

The muscles of the orbit are seven in num
the levator palpebræ; the rectus superior, in
ternus, and externus; obliquus superior and in

hich is *inserted* into the superior border of the artilage and into the superior palpebral sinus of the ctiva, behind the palpebral ligament. *Use*, to ele- id retract into the orbit the upper eyelid. From ure and extent of its connection with the eyelid, ts that the partial division of the tarsal ligament, the removal of the cartilage, does not take awa y ver of elevating the lid, as the paralysis of th s does; the elevation, however, under these circum-, is imperfectly performed.

recti muscles are four in number; the *superior* or *s oculi*, the *inferior* or *depressor oculi*, the *internal otor oculi*, and the *external* or *abductor oculi*.

RECTUS SUPERIOR.

rectus superior is broad, thin, and tendinous at its ities, and fleshy in the rest of its extent; *arising* he border of the foramen opticum and the partition m it and the foramen lacerum; inserted into the ic, about a quarter of an inch behind the cornea. *uperior* surface of this muscle is covered by the palpebræ; the *inferior* is placed upon the optic the ophthalmic artery, and the nasal branch of the lmic nerve, anteriorly upon the eye itself. This raises the eye.

RECTUS INFERIOR.

rectus inferior, similar in structure and figure to eceding, *arises* from a ligament which in part sur- the foramen opticum, and fills up the foramen

ir ; these two nerves are described by ...
is ganglion ; from the anterior angles of this ga
o fasciculi of fine nerves proceed, termed the *ciliar*
ferior fasciculus is larger than the superior ; the
rves are about twenty in number, eight or ten
ferior fasciculus, about six in the superior, and th
ur internally, which arise from the nasal nerve
liary nerves twine along the surface of the optic
ccompanied by the ciliary arteries, and pierce the
art of the sclerotic coat, they then become fla
roceed forward in parallel grooves on the inner sur
hat membrane, with very little connexion, to the c
oat ; at the anterior part of the eye they meet the
igament ; in this substance most of these nerves a
ience some consider this as a ganglion ; on eac
owever, one or two branches may be traced throu
nto the iris, in which they divide into numero
nents of extreme minuteness.

FUNCTIONS OF THE NERVES OF THE ORI

... of the orbit are as

ganglion will more properly come under consideration hereafter.

LACHRYMAL GLAND.

The *lachrymal gland* is situated within the orbit, at its upper and outer part, beneath the fossa in the orbitar plate of the frontal bone, and behind its external angular process. It is about the size of a small almond, and will readily be discovered, either by dividing the integuments of the upper eyelid, and then dissecting towards the cavity of the orbit, between the upper tarsus and the supra-orbitary ridge, or by dividing the conjunctiva uniting the upper tarsus to the eye, and then drawing the eye a little forwards. The gland is a yellowish white body, of an oval flattened figure, divided by a cleft into two lobes, of which the superior and internal is the smaller and thinner, the inferior and external the large extremity of the gland. Its position is oblique; the inferior and internal surface ollowed to suit the convexity of the globe; the superior onvex, to suit the corresponding concavity of the orbit,) which the gland is attached by a ligament passing ansversely beneath it. It measures in length about ten ies; in breadth five or six. In structure it is conglo-rate, consisting of numerous small granular portions, lobules, connected together by dense cellular tissue, m which its vessels and nerves ramify, to supply the nules of which it is composed. The vessels enter the id posteriorly, and from the anterior margin, its ducts, or six in number, pass out in straight lines, and ce the conjunctiva at the orbitar edge of the superior is.

SITUATION.

The eye is situated at the anterior and inte
:he orbit, behind the conjunctiva, surrounded
ınd fat, and connected anteriorly to the eye
:onjunctiva, posteriorly retained in its place b
:he optic nerve.

SIZE.

The size of the eye varies but little in diff
ɾiduals. The apparent difference arises eithe
lifference in the degree of projection of the ey
ɜnt individuals, a circumstance which is dete
:he relative volume of the ball and its socket
ɾariations in the form of the eyelids, and in
ter of the opening between them. When this
wide, a large extent of the eye is exposed, and
ɔrgan seems to be large and project forwards.
ɜize of the opening between the lids produce
ɜite impression. When paralysis affects the

der, and more delicate in texture, is gene-

FIGURE.

of the eye is such that it represents portions
s of different diameters. The posterior
the organ is the larger sphere, while the
is a section of a smaller sphere. The *eye*,
ıot exactly spherical, the *antero-posterior*,
, which is nearly an inch, being about one
reater than the transverse or vertical axis.
e is parallel in the two eyes.

COMPOSITION.

composed of fluids or humours enclosed in
branes; these membranes are,—
rnea.
erotic.
.
oroid and its appendages, the annulus and
ciliares.
tina.
—
ueous humour.
ystalline humour.
reous humour.
s the anterior transparent membrane which
the rays of light.
: is the external fibrous opaque investiture

The iris is the coloured membrane in which the aperture termed 'the pupil' is formed.

The choroid is the vascular membrane of the eye, and the dark screen which confines and condenses the rays of light. Its appendages are auxiliary to this purpose, and to other parts of the economy of vision.

The retina, or nervous coat, is the membranous expansion of the optic nerve, upon which the images of external objects are painted.

The humours give shape to the eyeball, and support its tunics.

The crystalline is set in the vitreous humour, and washed in front by the aqueous humour.

SCLEROTIC COAT.

The *sclerotic coat* is the external covering of the eyeball, with the exception of one-fifth part, bearing a proportion to the cornea somewhat similar to that which the vitreous bears to the aqueous humour. It is a strong, opaque, fibrous membrane, extending from the optic nerve to the cornea, which preserves the globular figure of the eye, defends its more delicate internal structures, and serves as a point of insertion for those muscles which move the eye. About a line internal to its centre posteriorly, it is perforated by the optic nerve; this is a small conical aperture, which appears traversed by fibres, so as to present a cribriform appearance; it is doubtful, however, whether this indistinct appearance may not partly depend on the central vein and artery of the retina, which accompany the nerve through this opening; *the sheath of* the optic nerve is continuous with this

membrane. Anteriorly it receives the cornea, and is so intimately connected with it, that maceration alone can separate them; both are sloped off obliquely as well as slightly grooved; the sclerotic overlaps the cornea, and their connexion is still further secured by the conjunctiva externally, and by the membrane of the aqueous humour internally. The sclerotic, around the entrance of the optic nerve, and likewise around the margin of the cornea, has many small oblique passages, of which the apertures on its internal surface are conspicuous when separated from the choroid, for the entrance and exit of the ciliary vessels and nerves. In structure it is dense and fibrous, these fibres presenting, on maceration, a reticulated appearance: it has few nutrient vessels, and no traceable nerves; its texture is both extensile and elastic. In the fœtus and infant it admits of separation into two plates or layers, but these are inseparably connected in the adult. Externally, the sclerotic is of a blueish-white colour, and rough. Internally, it is smooth and glistening; it has also furrows in right lines, in which the long ciliary vessels and nerves are lodged. Throughout the greater part of their extent, the sclerotic and choroid coats are loosely connected together through the medium of blood vessels and cellular tissue; but around the opening through which the optic nerve passes, the union between these two membranes is more firm. The density of the sclerotic is not uniform; a vertical section of this membrane from behind forwards, will show its greatest density to be posteriorly near the optic nerve, where it is about a line in thickness, and it becomes gradually thinner towards its front margin, where it is again

The cornea forms the anterior fifth of the external me
nous covering of the eye; it is nearly circular, its tra
se diameter being a little greater than its vertical. T
terior or convex surface is covered by a fine and clos
hering membrane, which, though generally conside
ontinuation of the conjunctiva, is very different fr
in its structure and properties. The posterior or c
ve surface of the cornea is lined by a fine elastic m
ane, which, by some, is described as a part of the m
ane of the aqueous humour; it is however a membr
i *generis*; it is best seen in the eye of the horse wh
s been macerated for some days; the external lami
ich are now opaque, can be peeled off, leaving beh
this elastic cornea, which preserves its proper curve
nsparency; if it be cut, it will curl up in itself, t
hibiting true elastic cartilaginous properties. The st
re of the cornea is horny, less extensile than the sclero
d perfectly transparent. It is onion-like, composed
ncentric lamellæ or pellicles, connected by a delicate
[illegible] containing a transparent fluid, in which ov

ich the lamellæ of the cornea do not possess, is lost at the approach of death, by the transu- ıe aqueous humour. They are scabrous from n of the cellular membrane connecting them, lustre.

ea is of greater thickness than the sclerotic in whom its posterior surface is contiguous to the internal surface is likewise half a line broader ıter, the margin being obliquely extended from wards, to correspond with the sloped edge of c. After maceration, it may be detached from c, to which it is connected by cellular tissue; tion is most readily effected by plunging the eye into boiling water. A fine transparent hu- reted by colourless exhalants in the areolæ of : membrane between the lamellæ of the cornea. itial substance of the cornea receives no coloured Numerous lines have been observed to form many sides between the plates of the cornea in the negro, and supposed, from a reddish tinge, l-vessels. The existence of nerves has never nstrated, and it is much to be doubted if it pos- The convexity of the cornea is greater than e sclerotic, being the segment of a sphere seven ı half in diameter.

CHOROID COAT.

:t membrame we have to examine is the choroid, xposed in the following manner: fix the eye in llow vessel, which can be readily immersed un- carefully raise a small portion of the sclerotic,

f the knife, the cornea or one half of it, may also
ıoved with the sclerotic, and the next tunic of the e
·e exposed, the *choroid*, with its appendages, the
igament, ciliary processes, and iris.

The *choroid membrane* extends from the circum
)f the optic nerve to the margin of the exterior
:ened surface of the vitreous humour, there it term
:ogether with the retina, in a greyish coloured su
termed ganglion, or ligamentum ciliare, or better,
ciliaris, and which is the common centre of union
interior membranes of the eye.

The external surface of the choroid is of a dusk
colour in the adult, reddish in infants, and adhe
an abundant and lax cellular tissue, which may b
inflated, to the sclerotic coat, and by the numerou
vessels and nerves which perforate the latter to t
course upon the choroid. This cellular substance
plentiful in the infant than the adult, and is mos
ant in the track of the principal vessels and nerv
vessels terminating upon it are extremely numer

ish, thicker and deeper coloured in the infant
adult; but having no connexion by texture
, its stain is not communicated to that mem-
ound the insertion of the optic nerve, the cho-
tute of this dye. Residence for some time in
vers a fine white flocculent substance coating
of the choroid, formerly described by Ruysch
membrane, (*tunica Ruyschiana*,) but not re-
is light by modern anatomists. The pigment,
no doubt, is secreted into a fine cellular tis-
f which are detached in some diseased states
, from the ciliary processes and back part of
ming to all appearance a real membrana nigra.

Nerves and Vessels of the Choroid.

ry nerves run in parallel lines, at equal dis-
the choroid; and from their equal size and
re particularly conspicuous. The long ciliary
ear, one on either side of the globe, in their
e annulus ciliaris. Beneath these the mem-
its, on its opposite sides, vessels arranged in the
s with weeping branches, or of the figure of a
hese, which have been named vasa vorticosa,
turning the blood distributed to the ciliary pro-
are collected into three or four distinct venous
e short posterior ciliary arteries pass under the
, in the intervals of the trunks, to the interior
id; and uniting with the anterior at the fore
globe, their extremities form a very intricate
ul net-work upon its interior surface. The
the choroid to the sclerotic is most strict, ad-

he *ciliary ring*, or *ligament*, is an elastic ring, cor
short and dense pulpy texture, closely adherent
r border of the sclerotic, at the distance of a li
lf from the external circumference of the corne
f greater breadth on the temporal than on the
. The choroid and retina adjoin its greater, t
and iris its lesser circumference. Anteriorly
es firmly to the sclerotic, as before observed, a
ary processes are attached to its posterior sur
it it forms a common centre of union for these
colour is observed to correspond to that of the

CILIARY PLAITS OR PROCESSES.

On the internal surface of the choroid, at the
e ciliary ligament, the plicæ or processus ciliar
delicate striæ, and advancing a little anterior
rcumference of the crystalline lens, terminate i
e of fine grey points at the base of the iris.
ar to be radiated folds of the choroid coat, from

terstices coated with pigment. These edges of the plicæ are engrooved in the duplicature of the vitreous capsule, which assists in forming the canal of Petit.

The extremities of the processes projecting from the interior border of the annulus ciliaris interdigitate with the radical fibres of the iris. To obtain a view of them, let the cornea be accurately removed at its junction with the sclerotic, and the iris be torn away, entire, from its ciliary attachment. The points of the processes will then appear, projecting like the teeth of a comb from behind the annulus ciliaris; and the ciliary border of the iris, upon floating it in water, will be found to present a corresponding arrangement.

The processes having their edges thus inlaid in the tunica hyaloidea at the margin of the crystalline fossa, and their points or anterior extremities interlaced with the radicle fibres of the iris, form a posterior iris, the aperture of which is exactly occupied by the crystalline lens and its capsule. From their origin to their insertion, they are supported exteriorly by the annulus ciliaris, with which substance they are in fact incorporated. The figure of each plica ciliaris is triangular, the internal obtuse angle being opposed to the circumference of the crystalline lens; the posterior, elongated, loses itself in the choroid; the anterior is inserted into the iris. The anterior edge is attached to the annulus ciliaris and root of the iris, the posterior to the tunica hyaloidea, and the internal and shortest measures, the space between the verge of the crystalline lens and the basis of the iris; or in other words, forms the outer boundary of the posterior chamber.

d dividing the corneal from the sclerotic ... rendered imperfect as a septum by the pupilla ble in its centre. The pupil is not, however, (al in relation to the iris, the breadth of the lways somewhat less on the nasal than on the ide. It is divided into a ciliary and pupillary Its attachment is, as already observed, by inden the extremities of the plicæ choroideæ, at the in gin of the annulus ciliaris, from which it origina ciliary portion of the iris is the larger one, an posed of a delicate fibrous and vascular tissue grey serpentine lines or striæ are seen proceedin from the ciliary ligament; from this the small portion is distinguished by a darker shade of a gently elevated circular line, most conspicu posterior surface of the membrane. The fi portion of the iris have a similar tortuous d are convergent towards the pupillar apertur pillary margin is thin and defined, and pres ... circular line when placed

Vessels and Nerves of the Iris.

The ciliary vessels, entering the anterior part of the ›be, unite with the other detachments, and form arches the base of the iris and processes. From the zone thus oduced, *(zona major,)* the branches run in straight lines ›on the iris. In the dilated state of the pupil these ra- ated vessels are tortuous; by its contraction they be- me straight. At the distance of rather less than half diameter from the pupil, another zone is formed by eir anastomosis, from which branches are detached to e margin of the pupil. The *zona minor* gives the ap- arance of the undulating circular line, distinguishing e pupillary from the ciliary portion of the membrane. ıe two long ciliary arteries chiefly contribute to the mation of these zones, and the supply of the iris. The ort ciliaries, seen upon the interior of the choroid, detach merous fasciculi to each ciliary process, which pursue erpentine course along the fixed edge of the fold, and e inverted to form concentric arches upon its opposite e margin. The nerves which supply the iris, are nches derived from the lenticular ganglion, and nasal rve.

Membrane of the Pupil.

There is a delicate vascular, which has received the me of membrana pupillaris, that closes the pupil in the tus, and is ruptured, either at birth, or a short time rvious.

STRUCTURE OF THE CILIARY LIGAMENT.

Of the peculiar structure of the ciliary ligament nothing

liary ligament appears to be a [illegible]
ination of the choroid coat, and the ciliary proces
le plaits or doublings of this membrane laid bac
o accommodate it to the area of the posterior ch

STRUCTURE OF THE IRIS.

Similar uncertainty prevails as to the struct
iris, the different opinions of its texture bein
rather upon inference from its functions than
monstration. If the former species of evidence b
it is muscular, and accordingly, some anatomis
it as consisting of two sets of muscular fibres,
trio round the pupil, composed of circular fibr
ing the pupil in the manner of a *sphincter;* t
diated, and having by its muscular action t
contracting the iris from the centre to the ci
and consequently enlarging the pupil. Other
ceive that the phenomena of its action can be
on the supposition that it is both muscular
and that these forces act alternately.

over the dissection; the retina will become slightly opaque, and have a magnified appearance. The optic nerve having perforated the sclerotic and choroid coats at the internal and posterior parts of the globe, terminates abruptly in a little white conical eminence or papilla. From the base of this papilla proceeds the very delicate membranous expansion termed *retina*. It encompasses the vitreous humour, the front part only excepted; where, within about two lines of the lens, the nervous matter terminates by an abrupt line, along which a small blood-vessel runs. It is of exceeding delicacy, and on dissection resembles, in semitransparency and in colour, the ground glass of which ornamental lamps are made. During life it is perfectly transparent. Without caution it cannot be preserved entire in dissection; and if, when the sclerotic and choroid coats are divided, the parts of the globe are separated by their weight, by its strict adhesion to the other coats at its origin, it is drawn off the vitreous tunic in the form of a fine medullary rope, which expands and reassumes its proper form in water. The retina is divisible into three layers; first *lamina serosa*, or Jacob's membrane, so called from its discoverer, Dr. Jacob of Dublin, an extremely delicate serous layer which may be separated from the external surface of the retina by gentle pressure with the handle of the knife, under water; second, *lamina nervosa*, which is soft and grey and continuous with the optic nerve; and third, *lamina vasculosa*, which is very delicate, lies on the vitreous humour, and is continued on its fore part to the capsule of the lens, where it becomes adherent to the hyaloid membrane. Dissect off the posterior half of the retina from

anches on the internal surface of the retina, in the
sculosa; about two lines external to this, and in t
the eye, is a small yellow or orange spot, the *pu*
ureum; the retina is thrown into folds around this.
escribe a perforation and deficiency of the retina
oint, under the name of *foramen centrale*, it rath
ears to depend on some peculiar organization. T
ernal surface of the retina is opposed to the chorc
nternal to the tunica hyaloidea.

AQUEOUS HUMOUR.

The name of anterior chamber is given to tha
omprised between the cornea and iris, ordinaril
ne line and a half in depth. The posterior
er, not exceeding a quarter of a line, is the space l
the iris and the crystalline lens. They commun
the pupil, and both are occupied by the *aqueous*
The aqueous humour is about five grains in quant
fectly transparent, having a specific gravity so
greater than that of water; it evaporates on exp

ture of the cornea, the pupil contracts, and the chambers are obliterated by the collapse of their parietes; it is however reproduced in a few hours.

VITREOUS HUMOUR.

The *vitreous humour* is the basis upon which the larger tunics of the eye are expanded, and fills a space somewhat exceeding two thirds of the globe of the eye. Upon its anterior surface, it is flattened rather abruptly, and presents a central cup-like depression, the dimensions of which exactly correspond to the posterior segment of the crystalline humour, which is embedded in it. It is a soft, gelatinous, and transparent body, consisting of a thin glairy fluid heavier than water, perfectly pellucid, and contained in cells formed by processes of a delicate membrane, called *hyaloid*, arranged in horizontal planes. Towards the back and sides of the humour these cells are larger than in the interior adjacent to the crystalline fossula; the septa are likewise thicker and stronger towards the circumference of the humour. After a careful section of the frozen humour, its substance may be picked out in solid wedge-like flakes from the interstices of the septa. The continuous covering, though of great tensity and perfect transparency, is of much strength, and resists, owing to the support it receives from the numerous septa internally, a considerable pressure. When lacerated or wounded, the humour of the corresponding cell or interstice is instantly evacuated; but if the wound is superficial, the humour does not escape in quantity, while supported by the other parts of the globe, or if removed from the globe, while suspended *in* water. But if in any way compressed *after a wound*, a dribbling of the humour goes on

ole extent of that ...

ly at the entrance of the optic nerve. The the humour is penetrated by a branch of th ntralis retinæ, which contributes a few very ssels to its containing membrane. In the fo ave been displayed ramifying on the capsule at f the lens.

CRYSTALLINE HUMOUR.

The *crystalline humour* is a transparent doub lens, situated on the fore part of the vitreous hu hind the anterior third of the eye, and a little its nasal than its temporal side. Its axis corr that of the pupil, a little to the inner side of t the eye. It measures in breadth about four line ness about two. The most convex or posterio lens, is exactly fitted to the cup in the fore vitreous humour; the anterior is opposed to t the circumference to the canal of Petit. It is by a proper capsule, which is thin and soft pos ...liarly elastic. A su

the lens. Inflation of this canal shews that it is not of uniform dimensions; like the large intestine, it is tacked up into cells or pouches by short transverse septa, whence the name given by Petit, *canal gauderonné*, or godronne. In the grooves corresponding to these septa, the posterior edges of the ciliary processes are inserted. The intervening looser portions of the membrane correspond to the interstices of the processes; and the black radiated lines, which appear upon the membrane of the canal, are stains left by the pigment which fills them. Like the ciliary ligament, the canal is broader on the temporal than the nasal side. This humour is perfectly transparent in a healthy state. In the fœtus and new born infant, it is spherical, semifluid, and has a slightly reddish tint. In the adult, it is gelatinous in consistency, its external lamellæ easily broken down between the fingers, but a nucleus of greater firmness is formed in the centre, which in some degree resists this pressure. In advanced age, the lens becomes more close and compact in texture, and the nucleus acquires a yellow or topaz colour.

Its texture.

The texture of the lens is lamellated; the lamellæ concentric and connected by a very delicate fibrous tissue. After maceration, the crystalline lens breaks into triangular pieces composed of concentric scales, of which the apices meet in the centre. The anterior may sometimes be separated from the posterior part of the lens, at the line of its circumference, as if it were composed of two segments of spheres of unequal size, applied face to face. The crystalline lens discovers no vascular organization.

THOUGH an examination of the phenomena and the laws which regulate it, may be con many as a subject more allied to philosophy t cine, yet as the description of the structure of would necessarily be incomplete, without at time giving an account of its functions, so on th would the preceding description of the struct apparatus of vision, be incomplete, were I to scription of the *physiology of vision*; and the hi diseases would want the illustration which a knowledge of its economy conveys.

In entering into the investigation of the an organ, which is acknowledged by all to be *fect* of optical instruments, it is clearly neces to the investigation a considerable share of kn cerning the laws of optics, and although, the ber will doubtless be in possession of tha it may not be out of place to po

wonderful property of communicating to us sens-
of colour, when adequate impressions are made

A blow upon the eye causes it to appear to flash
id pressure on the side of the eyeball excites a sens-
' coloured circles. The impressions by which we
hough of an incomparably more delicate nature
ie preceding, yet, like them, are mechanical im-
ipon the retina. They are produced by LIGHT.

NATURE OF LIGHT.

t consists either of imponderable and infinitely
material particles emitted from luminous bodies,
idulations of an ethereal medium supposed to per-
l space. A succession of particles on the one theory,
ndulations on the other, constitutes a ray of light.
f light move only in straight lines: their velocity
eat, that they travel from the sun to the earth, a
e of 95,000,000 miles in 8½ minutes. Light, there-
an intermediate agent through which bodies make
anical impression on the retina.

it emanating from luminous bodies forms diverging
which, if they met with no obstruction, would be pro-
indefinitely. Hence it has been concluded, that
tensity of light in any place, is in the inverse ratio
square of the distance of the luminous body from
it emanates.

SION OF BODIES INTO LUMINOUS, OPAQUE, AND TRANSPARENT.

ording to the different properties which bodies ex-
in regard to light, they have been classified into

luminous body: it belongs therefore to the class of *or dark bodies*, which comprehend all such as are luminous nor will admit the light to pass throug And *transparent bodies*, are those which admit tl to pass through them; such as glass and water.

No material bodies appear to be perfectly op transparent. Leaf gold sensibly transmits a light, and on the other hand, a depth of seven feet intercepts one half of the light which passes thro

Light moves in right lines; but its path is lia altered in two different ways, depending on the bodies it has to encounter in its progress.

CATOPTRICS, AND DIOPTRICS.

If the rays of light, in their progress, encounte bodies, they are reflected. The study of this l optical science is called *Catoptrics*. If, on the the rays of light impinge on transparent bodies, allowed to pass through them, not however ir line. but at an angle which varies with the dens

means of rays thrown back or reflected from their surface. Light in its reflection is governed by the same laws as solid, perfectly elastic bodies. If a ray of light fall upon an opaque body perpendicularly, it is reflected perpendicularly. If a ray of light fall upon a surface obliquely, it is reflected obliquely, but in the opposite direction, the angle of incidence being equal to the angle of reflection. The term reflection is usually confined to those cases in which the rays are thrown back in a definite order, either in lines parallel to each other, or uniformly convergent or divergent. To produce this species of reflection, a surface must be highly polished, in order that there may be uniformity in the angles at which the greater part of the rays are returned.

REFRACTION.

Refraction is the effect which transparent media produce on light in its passage through them. If a ray of light, in passing from one medium to another of different density, falls vertically on its surface, no refraction takes place, and it continues its course through the medium in its original direction. If the ray enter the new medium obliquely, it deviates from its course, and appears broken at the point of immersion, or that point of the surface at which the ray enters. If the ray of light passes from a rarer to a denser medium, it approaches the perpendicular at the point of contact; it separates from it, on the contrary, when it passes from a denser to a rarer medium. The same phenomenon occurs, but in an opposite manner, when the ray again enters the first medium; so that if the *two surfaces* of the *medium* which the ray traverses

int of immersion [illegible]
e *angle of refraction* is that which is made by th
y with the same perpendicular.

NGLE OF REFRACTION DEPENDING ON D

The extent of refraction produced by the same
epends upon the angle at which the rays of lig
3odies refract light in proportion to their de
:ombustibility. Thus, if two bodies are of equ
ty, but the one is composed of more combustible
than the other, the refracting power of the fir
greater than that of the second.

DIAPHANOUS BODIES.

All *diaphanous* bodies, when they refract ligl
flect it. In consequence of this property, thos
a certain extent, fulfil the office of mirrors. I
little density, as the air, they are not visible
mass is considerable.

DIRECTION OF THE REFRACTED RAYS [illegible]
[illegible] BODY.

According to the form of the refracting bodies, the rays of light have either a tendency to *converge* to a *point* or *focus*, or to *diverge*, or to proceed onwards in parallel lines. If the two surfaces of a body be *parallel*, the refracted rays are *parallel*. If either or both surfaces are *convex*, the refracted rays will *converge* to a central point. On the contrary, if the surfaces be *concave*, the refracted ray will, to an equal extent, *diverge* from the central point.

VARIOUS FORMS OF REFRACTING MEDIA.

The substance which is most commonly employed for refracting the rays of light, both in optical experiments, and in optical instruments, is glass: which, for these purposes is shaped into a variety of forms. 1st. A *plane glass*, in which the two surfaces are parallel. 2d. A *spherical lens*, which has every point of its surface equally distant from a common centre. 3d. A *double convex lens*, which is bounded by two *convex* spherical surfaces, whose centres are on opposite sides of the lens: it is either *equally* convex, when the radii of both surfaces are equal; or *unequally* convex when the radii are unequal. 4th. A *plano-convex lens*, which is bounded by a plane surface on one side, and a convex on the other. 5th. A *double concave lens*, which is bounded by two *concave* spherical surfaces, whose centres are on opposite sides of the lens. 6th. A *plano-concave lens*, which is bounded by a plane surface on one side, and a concave one on the other. 7th. A *meniscus*, which is bounded on one side by a concave surface, and on the other by a convex one; and these two surfaces meet at the circumference if continued. 8th. A

3th, all cause the rays of light to converge to a central point or focus. The 5th, 6th, and 9th, p divergence of the rays of light.

REFRACTION MODIFIED BY THE RELATION SURFACES.

The rays of light, when transmitted through a having both surfaces *parallel*, undergo two refracti at the point of *immersion*, and the other at the emergence, and these being equal and in *oppos* tions, no sensible effect is produced, and the rays onward in *parallel lines:* if, however, the two su the refracting medium be not parallel, then th light, in passing through it, will in like manner two refractions, but these will take place in the rection, and therefore the rays of light, after fracted, *will not be parallel;* if the surfaces b those rays which fall obliquely upon it will be *towards* the axis, and will meet at a point beyon called its *focus*, a point which depends both

COMPOUND NATURE OF LIGHT.

examine the rays of light, after they have under-
raction by means of a prism, we become aware of
us and important fact that ordinary white light
composed of a multitude of rays of different
nd different degrees of *refrangibility*. If a bundle
s made to pass through a glass prism or any other
g body, whose surfaces are not parallel, the bundle
, and if, after its departure from the body, it is
upon a plane, as a sheet of paper, it is found to
. large extent, and instead of producing a white
; produces an oblong one of many colours, suc-
each other by insensible degrees, and among
he seven following are distinguishable; red,
yellow, green, blue, indigo, and violet. Each of
lours is indecomposable; their assemblage forms
spectrum. The primitive colours are stated by
be only three, red, yellow, and blue: and that
mediate tints of orange, green, indigo, and violet,
combinations of the other three; this, however,
r for dispute. Light, therefore, is not simple and
eous, but is made up of innumerable coloured
ich by their union constitute white light. The
d nature of light is proved, as I have already
y the action of the prism, by means of which the
coloured rays, of which white light is composed,
rated according to the angles at which they are
l. The violet rays have the greatest angle of re-
consequently they deviate most from their origi-
se, and appear at one extremity of the spectrum.

which, [illegible]
deviate least from their original [illegible],
appear at the other extremity of the *spectrum*
pound nature of light may be further prove
that by the recombination of these coloure
light is again produced. This can be done
coloured rays, which have been separated b
upon a lens, which will make them converg
and, when thus reunited, they will appear
did before refraction: or, if a card be pa
partments with these seven colours, and m
rapidly, the same effect will be produced, w
the result.

THE CAUSE OF COLOUR.

Upon our knowledge of the compound
depends the explanation of the colour of
does not absolutely reside in the body i
pendent on the power which material
absorbing some rays, and reflecting o
[illegible] when viewed by white light a

eflected rays, it can only appear of the colour of those ays. Objects in the dark have no colour, or are black, which is the same thing. Light is composed of colours, herefore there can be no colours without light; and hough every object is black, or without colour in the lark, it becomes coloured as soon as it becomes visible. Though bodies from the arrangement of their particles, have a tendency to absorb some rays and reflect others, yet they are not so perfectly uniform in their arrangement as to reflect only pure rays of one colour, and perfectly absorb the others. A body reflects, in great abundance, the rays which determine its colour, and the others in a greater or less degree, in proportion as they are nearer or farther from its own colour in the order of refrangibility. Bodies which reflect all the rays are white; those which absorb them all are black. Between these extremes, they appear lighter or darker, in proportion to the quantity of rays they reflect or absorb. Pale coloured bodies reflect all the coloured rays to a certain extent, which produces their paleness, approaching to whiteness; but one colour they reflect more than the rest: this predominates over the white, and determines the colour of the body. Since, then, bodies of a pale colour in some degree reflect all the rays of light, in passing through the various colours of the spectrum, they will reflect them all with tolerable brilliancy, but will appear most vivid in the ray of their natural colour. Transparent bodies also appear coloured by the light which they refract, and when seen by refraction, they often appear of a different colour, than when seen by reflection.

If it is inquired why such a body reflects a certain

colour, while another absorbs it? It may be answered, that this tendency, to absorb or reflect particular rays, is *supposed* to depend on the arrangement of the minute particles of the body, and that the diversity of arrangement renders some bodies susceptible of reflecting one coloured ray, and absorbing the rest, whilst others have a tendency to reflect all the colours, and others again to absorb them all. How far this may be considered in the light of an explanation, each must determine for himself.

In the preceding sketch, it has been attempted to explain, as clearly as our limits would permit, some of those general laws which regulate the reflection and refraction of light. We are now better qualified to enter into an examination of the physiology of vision, and to examine in what manner, the various portions of the apparatus of vision contribute to the performance of perfect vision.

APPARATUS OF VISION.

The apparatus of vision is composed of three parts.

The first modifies light.

The second receives its impression.

The third transmits this impression to the brain.

The texture of the apparatus of vision is so extremely delicate, that it is affected by the slightest cause; nature, therefore, has placed before it a series of organs to protect and preserve it in the conditions requisite for the exercise of its functions.

These protecting parts are the eyebrows, eyelids, and secretory and excretory organs of the tears.

EYEBROWS.

have many uses. The projection which
:ts the eye from external violence; the
oblique direction, and the oily matter
m, prevent the perspired fluid from run-
ɜ eye and irritating the surface of this
it towards the temple and root of the nose.
umber of the hairs of the eyebrows influ-
They usually vary with climate. In the
mates, they are very thick and black; in
mates, they may be thick, but are very
he eyebrows protect the eye from the im-
trong a light, more especially when com-
we increase this effect by frowning.

EYELIDS.

ver the eye during sleep, and preserve it
; of foreign bodies flying in the atmo-
rom blows by shutting almost instantane-
abitual motions, which occur after nearly
hey oppose the effects of the prolonged
r; they also moderate the force of too
r, by approximating, they allow such a
pass as is necessary to vision, but inca-
g the eye. On the contrary, when the
e open the eyelids widely, to allow as
to enter the eye.

EYELASHES.

ids are brought near each other, the eye-

lashes form a sort of grating, which permits a certain quantity only of light to pass at once. When the eyelashes are wet, the little drops on their surface decompose light as the prism does, and the point from which it emanates appears irradiated. The eyelashes, by separating into bundles the light which penetrates the eye, cause bodies on fire, during the night, to appear surrounded with luminous rays. This effect disappears the moment the lids are opened, or merely another direction given to the eyelashes. We may readily conceive that the eyelashes protect the eye from the particles of dust which fly in the air. Vision is always more or less altered in persons deprived of their eyelashes.

EYELIDS PERMEABLE TO LIGHT.

The closed eyelids are penetrated by a full light, so as in ordinary circumstances to occasion waking; and distress to persons whose eyes are inflamed. The superior tarsus, when drawn up, slides under the arch of the orbit, but retains its apposition to the globe, owing to the laxity of its attachment with the integument of the palpebra.

MUSCLES OF THE EYELIDS.

The levator palpebræ being purely a voluntary muscle, the simple suspension of its action effects the closure of the eyelids, as its contraction opens them in the act of waking. Hence, the disposition in the upper eyelid to fall, announces the approach of sleep. In febrile and exhausted states of the system, its impaired energy occasions the drooping expressed by the term "heavy eyed," *one of the most* characteristic symptoms in the physiog-

nomy of disease. A similar state belongs to some morbid affections of vision, of which I shall have occasion to speak hereafter. A voluntary closure of the eyelids, as when the eye is, from any cause, irritable to light, is performed by the orbicularis palpebrarum, which in some casualties and morbid states, contracts spasmodically, and the relaxation of this muscle assists the opening of the closed eyelids. In going to sleep and awaking from it, the lower lid is therefore passive; in a voluntary shutting and opening of the eye it participates, although inconsiderably, in both actions. Winking is an alternation of the actions of the levator and orbicularis, and therefore a seasonable relief to the former, and a means of preserving the moist and clear condition of the cornea. It is performed by a very slight contraction of the palpebral portion of the orbicularis. The combination of the action of the corrugator and orbicularis is seen in the strained closure of the lids to resist their separation by external force, knitting and depressing the eyebrows and throwing the nose and forehead into folds; and the equipoise of the actions of the orbicularis and levator is evinced in the approximation or screwing of the eyelids, and peering, as is customary in short sighted persons. When they are both in full action, the corrugator acts as a moderator to the levator; the orbicularis is the antagonist of the latter.

CONJUNCTIVA.

The *conjunctiva* protects the anterior surface of the eye, secretes a fluid which mixes with the tears, and appears to

ntact of the air when not covered by [illegible]
) Mr. Travers, the idea that the conjunctiva is a secr
membrane, "rests solely on the supposed relation o
onjunctiva to the class of mucous membranes."
his need be no fetter upon our conception of the m
or not only do we see from the varieties of its su
that its economy is not throughout the same, but a
mists describe its continuity with the cutis as mu
with the membrana narium. Again, the capillar
mucous membranes carry red blood, which is not th
in the conjunctiva of the globe in health. But th
no evidence of such a secretion; upon the corne
not assumed to exist, yet the difference between t
neal and sclerotic portions is only in the strictnes
adhesion. The follicles and caruncula are spe
provided for preventing the effects of friction, a
incessant, although insensible escape of the tears f
lachrymal ducts, unavoidable under the act of win
which the upper lid sweeps over and preserves th
[illegible] renders such a provision superfluo
[illegible]

secretion can be set up by disease upon a whole sur-
, while in the healthy state this function is confined
s follicles and lacunæ.

young woman who had never shed tears, and was
pable of doing so, had a shrivelled, opaque, and cuti-
r conjunctiva.

SECRETION AND USE OF THE TEARS.

he *lachrymal gland* secretes the *tears*, and by means of
ral small ducts, pours them upon the conjunctiva at
ıpper and back part of the eye. But what becomes
hem when arrived at this part? This we shall now
ain. We observe, in the first place, that they must
in a different manner when we are asleep than when
are awake. When we are awake, the eyelids are
:nately approaching and separating from each other;
conjunctiva is exposed to the contact of the air; the
is in continual motion; nothing of this kind occurs
ng sleep.

hysiologists suppose that the tears flow in a triangular
l, destined to conduct them towards the great angle
ıe eye, where they are absorbed by the puncta lachry-
ia. This canal, they say, is formed, 1st, by the edge
ıe eyelids, whose surfaces, rounded and convex, touch
at one point; 2dly, by the anterior surface of the
which completes it behind. The external extremity
his canal is more elevated than the internal. This
osition, joined with the contraction of the orbicularis
ıcle, whose point is fixed to the nasal process of the
erior maxillary bone, directs the tears towards the
cta lachrymalia.

:amine the posterior surface of the eyelids
ontact, we can scarcely detect the line which ind
ie point at which they touch. Besides, if we
he existence of this canal, it can only serve fo
assage of the tears during sleep; we should still
o enquire into their course during the waking state

During Sleep.

During sleep, and whenever the eyelids meet, the
gradually diffuse themselves over all the ocular and
bral surface of the conjunctiva, and must stream
largest quantity where they find the least resistance
course which presents the fewest obstacles, is alo
part where the conjunctiva passes from the eye
lids; along this they easily arrive at the puncta
malia. The tears thus diffused upon the conj
must mix with the fluids secreted by this membra
experience the absorption, which it carries on.

When awake.

gives to the eye its polish and brilliancy; the increased or diminished thickness of this layer greatly influences the expression of the eyes; in empassioned looks, for instance, it is obviously thicker.

In the ordinary condition of the lachrymal secretion, the tears are not in the least disposed to overflow the lower eyelid. I know not upon what can be founded the use commonly ascribed to the fluid of Meibomius, of opposing this overflow, somewhat as a layer of oil upon the edge of a watery vessel opposes a watery fluid which rises above it. This effect of the Meibomian secretion I doubt, because it is soluble in the tears. The tears which do not evaporate, or are not absorbed by the conjunctiva, are absorbed by the lachrymal ducts, and carried to the inferior meatus of the nostrils by the nasal canal.

Muscular compression of the Lachrymal Sac.

The origin of some fibres of the orbicularis from the ligamentous expansion which supports and protects the lachrymal sac, gives it a power of compressing the sac in its contraction, and thus assists in the excretion of tears. This is in part proved by the epiphora which accompanies a fixed state of the lower palpebra from injuries, and the paralysis of the orbicularis, which states also prevent the due opposition of the puncta. Hence, too, people wink often and forcibly whose eyes are disposed to water, and after shedding tears.

EXCRETION OF TEARS.

The puncta lachrymalia absorb the tears, not by any capillary attraction, but by a vital action as absorbent

mouths. They are often spasmodically contracted, and afford a resistance to the introduction of Anel's probe, but yield to the point of a pin, so as afterwards readily to admit a probe of much larger dimensions. When over dilated, they lose for a time their absorbing power, and the epiphora is increased. When they are morbidly patulous and atonic, as sometimes happens in age, the epiphora is permanent; and their function is frequently arrested by inflammation of the sac, for we often find the epiphora altogether independent of obstruction. The direction of the superior duct varies a little in relation to the sac, according to the degree of elevation of the upper lid. By drawing the lid upwards and towards the nose, it is brought nearly into a line with the axis of the sac. The area of the sac and nasal portion of the duct, exceeding that of their orifices, facilitates the passage of the tears; the slight elevations of the lining membrane, and the narrowness and obliquity of the nasal opening, probably retard the excretion, which would be inconvenient if constantly taking place.

ACTION OF THE MUSCLES OF THE GLOBE OF THE EYE.

The actions of the *recti* singly, are to direct the eye four equidistant points of a circle, and, in concert turn the eye towards all the intermediate points: also exert a constant effort to retract the eye, against w the elasticity of the optic nerve, and of the adipose t in the orbit, would make a very inadequate resistan

The action of the *oblique muscles* is involved in *obscurity*: there can indeed be no doubt respectin *principal use*; by drawing the eye forwards they

that constant retraction which would otherwise be produced by the recti. But individually they are calculated to give, each its specific direction to the eye: the *obliquus superior* points the optic axis downwards and inwards; the *obliquus inferior*, on the other hand, directs the eye upwards and outwards. The combined actions of the whole preserve the relative position of the eye to the object, independent equally of the motions of the object and the head. The motions of the eyes are in perfect accordance, and the will cannot place them in opposition.

What renders this question still more intricate, is that three nerves are employed to supply the six muscles that have been described. The fourth nerve supplies the obliquus superior, the sixth supplies the rectus externus, and the third supplies the remaining muscles.

It is remarkable again, that of the six muscles of the eyeball, three turn the optic axis directly or obliquely outwards, (provided the obliquus superior is a rotator outwards, as many suppose,) and that each of these three muscles is supplied by a different nerve; two indeed have an entire nerve exclusively distributed to each of them.

The intricacy of the muscular motions of the eye admits, however, of a conjectural explanation. We may remark, that their distribution is not such as to allow of our opposing the recti to the obliqui: in following this indication we are stopped by the fact, that the third nerve supplies half or greater part of each class. But from the close anatomical relation between the origins of the third nerve and of the fourth, we may conclude *their* function to be not materially different; whereas the sixth nerve, rising from a *remote point*, seems distinguished from both *the others*.

It appears to be a principle universally observed in
construction of the nervous system, that nerves of mo
rise near the origin of those sentient nerves, thro
which the actions they control are habitually guide
called into play.

This principle is remarkably shown in all the s
nerves, and in the distribution of the fifth and sev
cerebral nerves; and the origin of the third and fo
nerves is perhaps sufficiently near that of the optic n
to bring them both under the same law. Now, whe
investigate the origin of the sixth nerve, we find it
ing to the back part of the medulla oblongata, so a
rise near the fifth and seventh; in other words, it
near those nerves which comprehend within their
tions, the sensibility of the surface of the eye, an
ence over the secretion of the lachrymal gland, an
sense of hearing. Again, when we examine the d
bution of the sixth nerve we find it forming the
supply of a muscle which has a remarkable consent
the three offices alluded to. The rectus externus o
cens oculi, which it supplies, directs the axis of the
outwards. And we may remark, 1st, that when the
axis is directed outwards, the surface of the eye is ca
towards the orifices of the ducts of the lachrymal gl
2dly, that the reversion of the eye for vision is comm
suggested by impressions upon the organ of hearing;
3dly, as an instance of the consent between the con
feeling of the eye and the action of the abductor,
when an animal is destroyed by pithing, if while in
fect life yet remains in the head, the eyelids be rend
incapable of closing by the division of the portio

and the surface of the eye be then touched, the motion of the eye to avoid the offending substance is in a direction outwards.

When the eyelids are kept shut, the eyes are often in motion. "Inter somnum quietum atque placidum, (observes Soemmering in his Icones Oculi Hannani,) bulbus oculi, ut in ipsis somnolentis videre licet, paulo plus sursum trahitur." In some instances this elevation of the axis of the eye during sleep is very considerable, in others it is very slight.

SQUINTING, ITS NATURE AND CAUSES.

Squinting consists in a want of consent between the muscles of the two eyes, through which defect the optic axes are habitually directed towards different points. The inclination of one eye inwards may be so great as to exclude it from the vision of objects towards which the other is turned, or may be so slight as to allow of the distorted eye taking in part of the same field of vision with its fellow. In either case, it appears that those who squint habitually neglect the impressions upon the distorted eye, and see with but one eye.

The *cause* of squinting is obscure: for though it frequently happens that the eye, which squints, has an imperfect vision, so as to favour the supposition that it is instinctively averted in order to prevent the perception of objects becoming confused; yet, in other cases, vision with either eye is equally good, and the patient can at will employ either singly, but cannot prevent the other from turning away from the object of vision.

Perhaps in cases of the latter description t adjustment of the two eyes is not true; so th were directed towards the same object, it mi sarily appear double.

THE REFRACTING MEDIA OF THE I

The eye consists of various parts, some of fract the rays of light in their course, whilst ceive and transmit the impression produced The refracting parts are,—

A. The *transparent cornea*, a refracting bc and concave, resembling very much in its fig parency, and mode of insertion, the glass placed face of a watch.

B. The *aqueous humour*, filling the cham eye; it is not purely aqueous, as its name imp composed of water and a little albumen.

C. The *crystalline humour*, improperly con lens. The comparison is exact as far as reg but with respect to its structure is completely for the crystalline humour consists of concer gradually increasing in hardness from the sur centre, and probably of different refractive po crystalline is besides enveloped in a membr experience proves to be of great importance in *lens*, on the contrary, is homogeneous throug surface, and every point of its substance, ar throughout the same power of refraction.

D. Behind the crystalline is the *vitreous* called from its resemblance to melted glass.

nours of the eye, according to Berzelius, con-

	Aqueous humour.	*Vitreous humour.*
. . . . .	98.10	98.40
. . . . .	a trace.	0.16
nd lactates . . .	1.15	1.42
animal matter soluble		
. . . . .	0.75	0.02
	100.00	100.00

Crystalline Lens.

. . . . .	58.
matter, analogous to the colouring	
r of the blood	35.9
s, lactates, and animal matter soluble	
ohol	2.4
matter soluble only in water . . .	1.3
le membrane	2.4
	110.0

racting powers of the humours of the eye are, to different observers, as follows :—

Aqueous humour.	*Vitreous humour.*	*Crystalline Lens.*		
		Outer coat.	Centre.	Mean.
), 1.335	1.335			
1.333				
1.329	1.332			
1.333				
1.336	1.339	1.376	1.399	1.383

ıe last of these measures we may deduce the fol-lices of *refraction* :—

In
ref

For rays passing from the aqueous humour into the outer coat of the crystalline humour . . 1

For rays passing from the aqueous humour into the crystalline, taking its mean index of refraction 1

For rays passing from the outer coat of the crystalline into the vitreous humour . . . (

Besides these refracting media, there are variou parts, each of which has some particular use in vis

A. The *sclerotic* membrane, the external coat eye, fibrous, thick and resisting, and evidently ir to protect the interior of the eye; it serves also insertion of the muscles which move the eye.

B. The *choroid* membrane, a vascular and r membrane covered with a black matter, whicl much importance in vision, by absorbing the sup light.

C. The *iris*, found behind the transparent co different colours in different persons, and pierced centre by an opening called *pupil*, which increa diminishes according to the intensity of the light.

D. The *retina*, or membranous expansion of t nerve, which is specially destined for the reception pressions made by the rays of light.

E. The *optic nerve*, through the medium of we become conscious of impressions made upon the

THE MECHANISM OF VISION.

The rays of light in passing through the vari mours of the eye undergo a series of refractions, b

ollected into focal points upon the retina, so as
complete picture of the external scene.

INVERSION OF THE IMAGE.

hat has been already said, it will be perceived
pencil will consist of a double cone of rays, the
ich are right lines, their bases meeting in the
, and their apices being situated in the object
tina respectively. The rays from the top of the
deflected to the bottom of the eye, and those
ide of the object to the right of the observer,
ed to the left side of the eye, and vice versa;
inversion of the picture upon the retina. The
simple experiment, demonstrating this fact, is
n. A portion of the coats being removed from
f the eye, and their place supplied by a piece
tracing paper, the flame of a candle placed be-
ornea is exhibited of diminished size, and in-
We infer, that this image excites the perception
ect, because distinct vision is enjoyed only in
rmations and conditions of the eye, as to allow
ccurately formed and impressed.
ok in a concave mirror, objects appear inverted.
e formed upon the retina is in this case erect,
e the object in the same relative position to the
all other objects. Of this fact any one may
himself, by preparing an eye, as before men-
d placing beside and a little behind the flame
idle a spoon, the hollow of which reflects it in-
aen he will observe on the opposite side of the

sight is corrected by experience. Some have supposed that the mind acquires objects, not from the picture upon the the object itself, by retracing the directi to their points of radiation. Others ass sation of the fibres of the optic nerve neous impression before it is presented t

Berkeley's theory. — The celebrated Berkeley, in so far as it admits of an abr is as follows. Visible and tangible ide provinces, and have originally no affinit It is only by experience that they become impressions on the organ of sight sugges the ideas of objects acquired by the sen in the same way as the word used to den mediately suggests the idea of that object, is familiar with the language. *The imag merely the instrument, not the object of visi* has originally no influence on the ideas situation of external objects, and the

and absolute negation of each sense in succession, so that each should be in turn insulated, is an impossible condition, notwithstanding the seemingly possible independence, in a state of society at least, of the animal and vital functions. Touch, in the extended sense of physical feeling, is the basis of all; sight, hearing, smell, and taste, like the sense of touch itself in its strict and limited import, are but modifications of it. That either or all of these, therefore, should be wanting, is not incompatible with their constitution; but the sense of contact is so essentially and individually incorporate with the organic nervous system, that its negation would be paramount to *acephalous monstrosity*. Hence its influence as a substitute and corrector in relation to the rest, when wanting can never be fully appreciated, because it cannot, like them, be subjected to analytical test. But from what we see of the effects of privation of one or more of the external senses, and of their reciprocity in general towards each other in cases of malformation and disease, is it not in the highest degree probable, that their natural intercourse and cooperation are essential to the development of each respectively? To illustrate this position. If it be possible to suppose a case in which the eye was the only external organ of sense, would the unfortunate possessor have any distinct idea of visible objects; or, mutatis mutandis, the ear of sounds? Certainly not. Dumbness is in most cases only a consequence of the absence of hearing; the organs of speech are perfect: so the loss of visual perception (not of light more than of unharmonized articulation) would result in the case sup-

posed, from the absence of the associated sensations and ideas thence derived.

Explained by the law of visual direction.—After all that has been said about the *inversion of the image*, and the perplexity which theorists have involved it in, by attempting to explain it; it will be found, if we admit the law of *visual direction*, to be not only easy of explanation, but to be, in fact, the only means by which correct vision could have been obtained. It has been stated to be the particular endowment of the retina, that when adequate impressions are made upon it, sensations of colour are produced. A very trifling addition to this statement contains the enunciation of a principle, upon which almost all the phenomena of vision depend, and to which the entire construction of the eye has reference. *When an impression is made upon the retina sufficient to produce sensations of colour, the colour appears projected in a line vertical to the point of the retina which has been excited.* Thus, if pressure be made with the finger upon the outside of the eyeball, a circular spectrum is seen in the direction of the nose; if the pressure be made at the upper part of the eyeball, the spectrum appears towards the cheek; if below, towards the eyebrow. The spectrum is always opposite to the point compressed, or is projected in a line vertical to the point of the retina which is excited to sensation. It appears that, by this endowment of the retina, the *direction* is rigorously determined, in which we can see by each point of its surface. The upper part, when excited, sees downwards, the lower part upwards, the inner outwards, the outer in-

wards. Through this law of *visual direction*, the inverted image on the retina is seen in the opposite or correct position.

Now the retina is to be used in giving us notions of the visual directions of objects, which are to correspond exactly with the notions that we derive from the sense of touch. Accordingly, we find placed before the retina a series of media, the effect of which is to produce true vision by means of the law of visual direction above mentioned: these are the *refracting media*, which have been already mentioned.

ABERRATION OF LIGHT FROM UNEQUAL REFRACTION.

In speaking of the refraction of rays at the surfaces of spheres and lenses, we have supposed that all the rays meet exactly in the focus. This, however, is not strictly the case; for if rays, falling on the surface of a sphere at a particular point, are collected to a focal point beyond this lens, other rays falling on the surface of the lens nearer to the axis, will have their focus at a point farther from the sphere than the former. This is easily proved by actually projecting the refracted rays, and if it is done for those rays farthest from the axis, and for those nearest to the axis, the difference between the foci of these rays is called the *spherical aberration*, or the *aberration* or *straying* of the rays from the focus, caused by the *spherical* figure of the lens. This aberration arises from the curvature of the lens being equally spherical, for if the surface of the lens was more convex towards the

must have different degrees of curvature
tances from the axis. The lens with lea
ration is a double convex one, whose r
to six; the side whose radius is one b
wards parallel rays. The aberration ther
thickness. As it is desirable to reduce th
all optical experiments, but more especia
the lowest possible degree, various contriv
adopted to accomplish this end. In opti
this is effected by the combination of le
forms, by which means their aberration
In the eye this is compensated by a va
which we shall now take notice of.

CORRECTION OF ABERRATION FROM REFRACTION.

The necessary effect of the spherical fig
nea is to occasion an unequal refraction of
permeate it, and hence to create a degree

OFFICE OF THE IRIS.

ien stated that the iris serves to arrest those are denied admission through the pupil: they nequally refracted by those points of the lens hich, if uninterrupted, they must pass, or so obliquely on the cornea, as to be subjected t a refraction. This is its passive function; power of dilatation and contraction, in obe- he stimulus of light upon the retina, it deter- quantity necessary for the purposes of distinct ı regulating the quantity of light, the iris ma- ists in accommodating the eye to different dis- viewing a distant object the pupil dilates, and a near one it contracts. It is true that view- ı occasions a contraction of the pupil, and the ion of a near object in deficient light, its dilat- ese are confirmations of the statement that its e in obedience to the impression of light upon because the direct emanation of light from its he one case, and the insufficient light in the ler these objects analogous in this respect to t and the remotest visible objects. But under ircumstances, the illumination of objects being le to the distance, the pupil, in viewing a dis- , is dilated so as to admit as many rays of the light as is necessary to the distinct perception ct; and on the other hand contracts, to ex- superfluous rays, which, coming from a near uld otherwise create confusion. Let a person *sun whilst* the pupil is fully dilated by bella-

all near objects will be in a degree confused, a
fusion be increased in proportion to the deg
illumination. Where the iris is from any ca
less, the power of adapting the eye to dista
I conclude, therefore, that the adaptation of
light cooperates with its adaptation to distan

Iris in part muscular.—Notwithstanding
of satisfactory anatomical proof, I cannot
the motions of the iris as muscular motio
pupillary portion an orbicular sphincter,
virons thé several outlets or apertures o
To this structure I attribute its uniformit
rying magnitudes; its incapacity of contra
having a fixed point, as happens in som
tions; when confined by adhesion at any
circle to the capsule of the lens, or when
has been the subject of adhesive inflammat
covery of a prolapse through a section of
and resuming its circular figure when over-
in extraction by a gentle friction of the

contraction in children, and the increase of its
r exercise, as in artisans incessantly employed
nute objects, in which it is apt to acquire a
which scarcely admits of dilatation.—Its obedi-
ll respects, to the laws which regulate the mus-
stem. — Its contractility in proportion to the
and perfection of the nerve of sense with which
ociated. — Its incapacity of perfect contraction
mulous, and its spastic contraction, even to the
of the influence of belladonna, in tetanus.—Its
n when the sphincters are relaxed, as in syncope,
apoplexy, or compression of the brain, and af-
se of alcohol in excess.—Its complete dilatation
der the influence of the sedative poisons, as
yosciamus, belladonna, &c., to which its proper
e in a peculiar manner irritable.

rtly elastic.—The ciliary portion of the iris I
an elastic structure. It is by virtue of its elas-
t the extraordinary dilatation of the pupil, such
under the use of belladonna, is produced. Here,
er parts, elasticity is opposed to muscular mo-
ce, when the latter is paralysed, or from any
ninished, the former strikingly predominates;
nervous supply is intercepted, the pupil gapes
e action of elasticity being independent of the
.

of animals.—All animals which have a move-
have the pupil circular, oblong, or elliptical,
ourable to the arrangement of marginal fibres.
he iris is evidently a prolongation of the choroid
nterruption of continuity; it is therefore no-

to a line, vertical (cat), or horizontal (add
ing to the figure of the pupil; or to a s
aperture, where it was of a circular form,
mon snake.

Mr. Travers's theory.—"If we look
treous humour exposed for a small space
surface, we observe the plicæ advancing u
surface beyond the margin of the lens, lil
or screen; if the lens is pressed evenly
plicæ separate and extend the sacculated c
which their edges are affixed. On remiss
sure, the lens springs forward and the le
are closed. The circumferential compress
increases the closeness of their application
body, only the most coarse and remote a
obtained to the functions of the living.
believe so obvious, and yet so exquisite, a
changing the site and figure of the apj
view affords, can be without necessity or o
ing, then, at the posterior origin of the

able parts of the apparatus, it follows that the plicæ will be unbraced and partially open in the state of mean dilatation of the pupil belonging to passive or atonic vision, and in the state of extreme dilatation of the pupil, accompanied with blindness to near objects, totally relaxed and floating.

"On the contrary, by the steadily contracted state of the pupil suited to the nearest extremity of the focal range, they will be closed and braced together; and, bearing upon the circumference of the crystalline at every point, will necessarily elongate the axis of the lens. These being the extreme states, so in proportion the intermediate degrees of adaptation will be accounted for. Hence the actions of the pupil, however excited, will extend their influence to the lens, and by this catenation of motions the general conformity of adjustment to light and adaptation to distance are to be explained. And this forms no objection to the hypothesis, because it is only in the voluntary and steadily preserved contractions of the pupil that the latter object is or can be required; for blindness would as surely ensue from gazing on the sun, as death from suspending the actions of the respiratory muscles, were it in our power to do either; and therefore the involuntary has the ascendancy over the voluntary action in both these cases, as it has in all cases of mixed muscles."

Uveal prolongations of the ciliary processes.—Radiated fibres are described by Haller and Zinn as raised on the posterior surface of the iris, and advancing even to the margin of the pupil. They are distinct from those seen on its anterior *surface*, and regarded as continuations of

the lens by the instrumentality of the
sule, it is true, is fixed by the processes,
no obstacle to the change proposed ; for
Petit, to which alone the processes are
when they are closed, and extended wh
rated, and thus permits the capsule to
degree required for the change of the l
words, preserves its exact adaptation t
lens in its opposite and varying states.
the use of the membranous circle of P
the processes the complete command c
capsule.

Dilatation of the pupil, with bulging o
cases of dilated pupil are accompanied
the lens. This is not the effect, but th
ation, for it never follows the applicati
provided the capsule be entire ; but i
the lens be protruded so as to bear dow
sistance of the processes, the pupil becor
pressure.

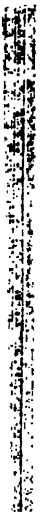
standing, upon watching the eye of a cat or of a hawk, the contraction of the pupil often appears to be voluntary. When the eye of the animal is bent upon an object that excites its attention, yet which does not shift its position, the pupil may be seen to enlarge and contract alternately. The animal is probably employed in examining the object under different lights, by intentionally admitting more or fewer rays through the pupil.

The iris is a mixed muscle; its motions are regulated in part by the stimulus of light upon the retina, and in part by an effort of the will.

Involuntary actions of the iris.—That the motions of the iris which take place upon the sudden changes of light are involuntary, there can be no doubt, for they are observed even in sleep, when the will cannot be exerted, and in the earliest infancy. There is another proof that these motions are involuntary, viz., that they occur in some forms of perfect amaurosis. The pupil has been observed to act briskly, where the person has been totally devoid of the perception of light from bright sunshine, or the flame of a candle held before his eye.

The sympathy of the iris with the retina must be ascribable to a communication between the retina and the ciliary nerves which supply the iris. The small lenticular ganglion, from which these are derived, lies upon the optic nerve, and is probably the medium of communication.

Voluntary motion of the iris.—On the other hand, every one may satisfy himself of a power which the will is capable of exercising over the iris, in alternately viewing near and *distant objects*; the state of relaxation or



the faculty is seldom exercised in these
and still more rare for the state of accon
preserved in defiance of the changes of l
is an unnatural effort. I have several
in persons whose eyes were steadily fixed
at some yards' distance, that the approac
wards the eye did not stimulate the pupil
until it was so placed as that its image
the most sensible part of the retina, whe
stantly contracted. So that the voluntar
nation to the involuntary, where they ar
is, when the stimulus of light opposes tl
the eye to distance. But by continued
mind is capable of acquiring an extraordi
the motions of the iris, as is well known
with other muscles subjected in any de
Of this, Dr. P. M. Roget presents a rem
tion, as shown by the following descriptio
which he possesses of contracting or dilat
pleasure.

in them, that this power is totally independent of the influence of light, since I can effectually exert it, although the position of my eye, with regard to the window or candle, as well as the direction of the optic axis, continues unchanged. However singular this power may appear, it admits, I conceive, of a very natural explanation. The effort, of which I am concious, when performing the voluntary contraction of the pupil, is the same as that which accompanies the adaptation of the eye to short distances, and is of course productive of an increase of its refractive power. This very same power of moving the iris in fact is possessed, in a greater or less degree, by every person who enjoys the faculty of distinct vision at different distances. It is accordingly well known, that if a person, after looking at a distant object, transfer his attention to a near object, the pupil always contracts. But this change, it is supposed, can never be effected, unless some real object or image, from which light radiates, be present to direct the sight. I have never, indeed, met with any person besides myself, who, while steadily directing his eye to a distant object, and while no other object intervened, could, by a mere effort of the will exerted on the eye, augment its refractive power so as to adapt it to the vision of near objects. That I have acquired such a power I can ascribe to no other cause than to my having, from my childhood, been much in the habit of observing optical phenomena, and of practising various experiments relating to vision, a subject which I early took great delight in cultivating.

" It is still more easy for me, while an object is placed near my eye *and distinctly* seen, immediately to relax

tion of the pupil. The increasing the
of the eye, is always the change that co
fort; the state of vision adapted to pa
that of complete relaxation. The effo
this voluntary contraction of the pupil,
object before the eye to call for such
lowed by a sense of fatigue; and if of
too long continued, it becames painful,
for a long time afterwards. The fatigu
exclusively in the eye to which my atte
directed during the experiment, alth
change takes place in the refractive p
lieve to the same extent, in the other
remarkable, that when there exists a rea
which is looked at, and which requires
in the eye for distinct vision, as in the
sense of fatigue, or hardly any, is experie

"I need scarcely add, that while I th
fractive power of my eye from that which
distance of the objects which I look at

source is derived the nerve which supplies the levator palpebræ, which is purely voluntary.

The limited motion which the pupil has when the retina is for the most part insensible, may be considered as an involuntary or automatic motion, similar to that which in a healthy eye affords protection to the retina; and if, as sometimes happens, the iris contracts in a state of blindness, this likewise must be regarded as its involuntary action, for volition cannot precede sensation. It is probable that those motions of the iris, which are in conformity to the impressions of light upon the retina, are purely involuntary; and that those which are in conformity to the situation of objects, and are therefore directly subservient to vision, are under the influence of the will. Hence the dependence of the adjusting faculty upon the perfection of the retina.

Various conjectures have been entertained respecting the functions of the ganglia; some have supposed that they were intended as bars or stops upon volition, and cited the iris, which they supposed to be purely involuntary, in support of their hypothesis. By others, ganglia have been supposed to be small *sensoria* or cerebral receptacles, capable of rendering a supply of nervous energy to their filaments, by which they are in a measure independent of the brain and its appendages. Mr. Travers attributes the voluntary motions of the iris to nerves unconnected with ganglia; the involuntary to those derived from the lenticular ganglion, which he regards as a direct medium of communication between these nerves and the retina.

On account of the obscurity which envelopes the actions of the third, *fourth*, and sixth nerves of the orbit, I in-

in which the subject is involved.

ON THE PECULIAR PROPERTIES OF TH THE EYE.

" We are ignorant as to whether the thi sixth nerves have sensitive in addition t power. Desmoulins asserts that, when the or pinched, no pain is produced ; but it is termine this with regard to such small ne the violence that is necessarily done to the ing them bare.

" The third nerve supplies the levator pal the superior, inferior, and internal recti, a oblique ; and from its branch to the latt ciliary or lenticular ganglion derives its sh the long root of this ganglion is supplie nerve of the fifth, and contains a filament f nous plexus of the sympathetic.

" The influence of the third nerve an nasal nerve on the iris, deserves a special

l branch of the fifth, has no influence over the

following are the results of his experiments on
ing pigeons, in which birds M. Muck has shown
iliary ganglion has two roots, one from the third,
· from the fifth nerve.

Vhen the optic nerves are divided in the cranial
a living pigeon, the pupils become fully dilated,
ıot contract on the admission of intense light.
lie also observed dilatation of the pupil, and immo-
the iris, as a consequence of division of the optic
dogs and cats; while the pupil became con-
ınd the iris immoveable when the same experi-
ı performed on rabbits and guinea-pigs.)

Vhen the third pair of nerves is divided in the
avity of a living pigeon, the same result ensues;
these cases the surface of the eyeball retains its

Vhen the fifth nerve has been divided on one side
anial cavity of a living pigeon, the iris on that
racts as usual on the admission of light, but the
f the eye appears to have lost its feeling (which it
rom twigs of the ophthalmic branch of the fifth).

Vhen the optic nerves are pinched in the cranial
a living pigeon, or immediately after its decapi-
ıe pupils are contracted for an instant on each
the nerves. (A phenomenon observed by Flou-
)

Vhen the third pair of nerves is irritated in the
dead bird, a like result ensues.

Vhen the fifth nerve is similarly irritated in the
no affection of the pupil is observed.

be pinched, no contraction of the pupil ensues; but if the
portion adhering to the brain be pinched, a like contrac
tion of the pupil ensues as if the optic nerve had
been divided.

"8. The previous division of the fifth pair of nerves,
in the preceding experiment produces no different
result.

"9. When the third nerves have been divided in the cra
nial cavity of the living or dead bird, no change in the pupil
ensues on irritating the entire or divided optic nerve.

"From these experiments we may with confidence con
clude, that the motor power of the ciliary ganglion and
nerves is derived from the third nerve, and that the retina
does not cause the contraction of the pupil by acting di
rectly on the ciliary nerves; but that the irritation of the
retina and optic nerve acts immediately upon the brain,
and from the brain is reflected upon the third nerve and
the short motor root of the ciliary ganglion. This may
be inferred also from the well known circumstance of
amaurotic from paralysis of the

" The nutrition of the eye is under the influence of the sympathetic twigs: we have already seen what an influence the sympathetic ganglion has over the nutrition of the eye; and that, after the superior cervical ganglion has been destroyed, inflammation of the eye with effusion ensues. M. Majendie found, that division of the fifth nerve in rabbits, guinea pigs, dogs, and cats, was followed by immobility of the iris, with dilatation of the pupil in dogs and cats, contraction of it in rabbits and guinea-pigs. These effects must depend on a reflected action through the medium of the brain. We can now enquire into the mode in which the third nerve influences the motion of the iris, a point respecting which I have made several original observations.

" The third nerve, when excited to action, voluntarily or involuntarily, frequently gives rise to contraction of the iris. Since the third nerve supplies all the recti muscles, with the exception of the rectus externus, we know that when the eye is voluntarily directed outwards, the third nerve is not active, and that it is so when the eye is voluntarily turned inwards. If one eye be closed and the other turned inwards, we may perceive that the pupil becomes contracted, and that it becomes dilated if the eye be directed outwards, the intensity of the light remaining the same. Hence it inevitably follows, that every voluntary motion of the eye, in which the branch of the third nerve to the internal rectus is engaged, is accompanied by action of the iris; and that, when the sixth nerve is acting, the iris is inactive, the pupil dilated.

If one eye be turned outwards, the other inwards, no *remarkable change in* the state of the pupil is observable

able degree, as in [illegible]
side, or directly in front, the contra[illegible]
comes very great; on the contrary, the mo
direction of the eyes, and the less the i
muscles, which are supplied by the third n
termined to action, the wider does the pupil

"Hence we have voluntary power over t
the iris; in other words, whenever the thir
cited to action by volition, the iris contra
looking at near objects the axes of the eyes are
verge,—the eyes are turned inwards; and h
direct our eyes to near objects, the pupil beco
tracted, and dilates when we look at distan
motions of the iris in birds are not really
the will than in man; the pupil becomes
birds, when we approach them and they b

"It is not, however, the branch of
which goes to supply the internal rec
that has this sympathetic influence ove
[illegible]nches, and particularly that which su
[illegible] the same power. T

according to the observation of Mr. Hawkins. At the moment of waking, the pupil, after a few irregular contractions, assumes its usual degree of dilatation.

" The facts drawn from *comparative anatomy* are generally confirmatory of the foregoing physiological results. The ciliary nerves are constantly supplied from the third nerve, and nasal branch of the fifth. The following varieties are met with :—

" 1. Branches of the third and nasal nerves unite as roots to form the ciliary ganglion. The ciliary nerves arise in part from the ganglion, and in part from the nasal nerve itself. This is the arrangement of the nerves according to the extended and accurate researches of M. Muck and Tiedemann in the dog, hare, ox, sheep, goat, deer, roe, hog, owl, pigeon, parrot, goose, turkey, and plover, (in the turtle also, according to Bojanus).

" 2. The ciliary ganglion connected more immediately with the root derived from the third nerve ; the ciliary nerves arising from it, going partly to the eye directly, and partly uniting in a looped manner with ciliary branches of the nasal nerve, some filaments of which are continued separately to the eye. This structure has been found in the cat, falcon, heron, raven, cock, duck, merganser, and tern. I regard this form merely as a variety of the former.

" 3. In the rabbit, Muck found no connection of the third and nasal nerves forming roots of a ganglion ; both those nerves gave off ciliary twigs separately. According to Retzius, the ciliary ganglion is here situated nearly within the sheath of the third nerve.

" 4. Desmoulins *asserts* that the nasal nerve gives off

liary branches from the third nerve, whi
their principal sources when the iris
motion. M. Muck and Tiedemann as
that in the horse the ciliary ganglion
the motor oculi nerve gives off no cili
Retzius has discovered a very minut
two roots, one derived from the third.
in error, likewise, in stating that in
none of the ciliary nerves are derive
nerve.

" 6. In fishes, the iris is nearly un
able. Muck and Tiedemann found ci
hucho, which arose from the third ne
nasal, and in part anastomosed with
carp, the ciliary nerves arose from the
the researches of Professors Schlemm
appears that fishes do not differ from ot
spect to the ciliary, which they found
rived from the usual roots.

Schlemm and D'Alton found the same to be the case in the petromyzon or lamprey.

"9. In the lampreys there are, according to Schlemm, two special nerves for the muscles of the eye; namely, the motor oculi, and trochlearis, which unite in the orbit.

"10. In the myxinoid fishes, the third, fourth, and sixth cerebral nerves are wanting, as well as the muscles of the eye.

"*Influence of the brain on the motor nerves of the eye.*—Desmoulins and Majendie state that, when the peduncle of the cerebellum is divided in mammalia, the eye of the corresponding side is directed downwards and forwards, the eye of the opposite side upwards and backwards; section of the pons varolii was attended with the same result."

CORRECTIVE AND ACHROMATIC POWER OF THE CRYSTALLINE LENS.

It has been shown that part of the rays which are dispersed by *spherical aberration*, are arrested in their progress by the iris: this aberration is still further corrected by the peculiar structure of the lens, the refractive power of which is so adjusted to that of the contiguous aqueous and vitreous humours, as to correct the aberrations which the figure of the cornea would occasion, and to throw the most oblique rays with sufficient accuracy upon the concave surface of the retina. Not only is the clearness of the image undisturbed by superfluous light, but it is also destitute of colour, the decomposition of light by irregular refraction, being in ordinary vision prevented or corrected by the structure *and* curvature of the crystalline lens.

at the eye in its natu...
undergoes no such decomposition in ... the humours.

According to Dr. Brewster this is not st who says that no provision is made in the the correction of colour, because the de differently coloured rays is too small to pro ness of vision. If we shut up all the pu portion of its edge, or look past the finger eye, till the finger almost hides a narrow light, we shall see a distinct prismatic s line containing all the different colours; could not take place if the eye were achr

USE OF THE CHOROID AND BLA

For perfect vision with the human quisite that the rays of light should un after reaching the retina. To provid delicate membrane called the choroid ... the retina, secretes in the

of the peculiarity of structure is not equally obvious, ack part of the choroid is covered with a membrane ɔd the *tapetum lucidum*, which presents a brilliant ting surface. The lustre of the eyes of cats in an ıre place results from this cause. It is supposed that ouble impression of a low degree of light upon the a may be equivalent to the single impingement of ıter light. M. Majendie ingeniously compares with lisposition of parts, a structure observed by himself in yes of birds remarkable for their acute vision. In the , the retina lies in numerous folds, so that we may ɔse it several times perforated by the rays of light. ıe eye of the Albino is remarkable for its want of pig- ıum nigrum, in consequence of which the pupil and ıre coloured of different shades of red. In such per- vision is weak in the ordinary light of day, and dis- only in a darkened room, or at twilight. The eyes binoes are likewise observed to be in continual motion, nsciously oscillating from side to side, even when their ; is most steadily bent upon an object. There can ıtle doubt that this provision is intended to save the otected retina, by preventing a continual impression of ıe intensity upon one point. Other people use one of the retina for perfect vision and direct it succes- y towards the different points of an object while ıining it; the Albino uses several, continually alter- ıg from one to the other. The motion is unattended . any apparent change of place in the object, (such as which occurs when the eye is pushed or drawn aside,) ı the same principle as when for experiment's sake we ıtionally *roll the eye from* side to side; the scene before

us in
parts of the retina
successively delineated, are in
to the same point in space.

THE SEAT OF VISION.

The action of the retina is a vital one, th
of which is completely unknown; it being
which the refracted rays are converged to
purpose of conveying an impression to t
retina receives the impression of light w
certain limits of intensity.

When the eye is steadily directed to o
by a very faint gleam of light, it is thr
painful agitation. A kind of remissio
conveyance of the impressions along
brane; the object actually disappears
tated by the recurrence of impres
feeble for the performance of its fun

When too strong a light has sudd
the impression is called *dazzling*,
moments afterw

tion, we direct to that point the axis of the eye, and consequently, the image of that point falls upon the central hole in the retina; every other point of the same object is seen indistinctly, and the indistinctness increases with the distance of the point from that which is seen distinctly. The centre of the retina, therefore, appears to enjoy a more lively sensibility than the rest, and it is upon this part we throw the image, when we wish to examine an object with attention. This is not, however, confined to the axis of vision; for in certain positions of the eye, artificially induced, we have a clear perception of an object, from which the rays pass so obliquely, as to fall upon the retina not in the axis of vision.

Indistinctness of vision at the base of the optic nerve.—It was discovered by M. Mariotte, that when the image of any external object fell upon the base of the optic nerve, it instantly disappeared. In order to prove this, we have only to place upon the wall at the height of the eye, three wafers, two feet distant from each other, shutting one eye, stand opposite to the middle wafer, and while looking at the outside wafer, on the same side as the shut eye, retire gradually from the wall till the middle wafer disappears. This will happen at about five times the distance of the wafers, or ten feet from the wall; and when the middle wafer vanishes the two outer ones will be distinctly seen. If candles are substituted for wafers, the middle candle will not disappear, but it will become a cloudy mass of light. If the wafers are placed upon a coloured wall, the spot occupied by the wafer will be covered by the colour of the wall, as if the wafer itself had been removed. From this we learn, that there is a certain part of the retina less

sensible to ordinary impressions of light; further, part may be shewn to be the base of the optic ne which is about the eighth of an inch in diameter.

Choroid seat of vision.—This circumstance induced M riotte to consider the choroid as the seat of vision rather t the retina; for, argued he, there is no deficiency of t nervous matter of which the retina is an expansion, the choroid is wanting. The opacity of the choroid coat the transparency of the retina, which rendered it an u ground for the reception of images, were arguments in vour of this opinion. Comparative anatomy furnishes with another argument, perhaps even more conclusive t any of those urged by Mariotte. In the eye of the *se loligo*, or cuttle fish, an opaque membranous pigment is terposed between *the retina and the vitreous humour;* so t if the retina is essential to vision, the impressions of image on this black membrane must be conveyed to the tina by the vibrations of the membrane in front of it. N since the human retina is transparent, it will not prev the formation of images on the choroid; and the vib tions which they excite in this membrane, being comm nicated to the retina, will be conveyed to the bra These views are strengthened by another fact of some terest. Sir D. Brewster has observed in young perso that the choroid coat (which is generally supposed to black, and to grow fainter by age) reflects a brilli crimson colour, like that of dogs and other anim Hence, if the retina is affected by rays which pass throu it, this crimson light which must necessarily be transm ted by it ought to excite the sensation of crimson, wh *I find not to be the case.*

The correctness of Mariotte's conclusions, on which this singular theory is founded, is extremely questionable. If, in his fundamental experiment of the three wafers, we substitute three candles, we then find, that though no image of the centre object is formed at this part, it is still not insensible to light, for a diffused reddish light appears to occupy the place of the flame. The base of the optic nerve therefore is not insensible to light, as Mariotte's hypothesis supposes; it is only unfit for giving distinct vision of those objects whose images fall upon it, in consequence of being placed on the projection of the central artery which accompanies it. The red nimbus results from the passage of light through this blood-vessel, the irregularity of which prevents it from transmitting the image.

Seat of vision in the vitreous humour.—A French writer, M. Lehot, has recently written a work endeavouring to prove that the seat of vision is in the *vitreous humour;* and that, in place of seeing a flat picture of the object, we actually see an image of three dimensions, with length, breadth, and thickness. To produce this effect, he supposes that the retina sends out a number of small nervous filaments, which extend into the vitreous humour, and convey to the brain the impressions of all parts of the image. If this theory were true, the eye would not require to adjust itself to different distances; and we besides know for certain, that the eye cannot see with equal distinctness two points of an object at different distances, when it sees one of them perfectly. M. Lehot might indeed reply to the first of these objections, that the nervous filaments *may not extend* far enough into the vitreous

humour to render adjustment unnecessary; but
admit this, we would be admitting an imperfecti
workmanship, in so far as the Creator would th
employing two kinds of mechanism to produce an
which could have been easily produced by either of
separately.

Such are the theories that have been entertain
specting the seat of vision, and as difficulties still
to every opinion respecting the seat of vision, w
still adhere to the opinion most generally adopted
the images of objects are painted upon the retina.

THE LAW OF DISTINCT VISION.

When the eye is directed to any point of a lands
sees with perfect distinctness only that point of it
is directly in the axis of the eye, or the image of
falls upon the central hole of the retina. But,
we do not see any other point but one with that di
ness which is necessary to examine it, we still
other parts of the landscape with sufficient distinct
enable us to enjoy its general effect. The extren
bility of the eye, however, and the duration of t
pressions made upon the retina, make up for thi
rent defect, and enable us to see the landscape as p
as if every part of it were seen with equal distinct

The indistinctness of vision for all objects situa
of the axis of the eye increases with their distan
that axis; so that we are not entitled to ascribe t
tinctness of vision in the axis to the circumstance
image being formed on the central hole of the
where there is no nervous matter; for if this w

case, there would be a precise boundary between distinct and indistinct vision, or the retina would be found to grow thicker and thicker as it receded from the central hole, which is not the case.

Intermission in the vision of the objects seen obliquely.—In making some experiments on the indistinctness of vision at a distance from the axis of the eye, Sir D. Brewster was led to observe a very remarkable peculiarity of oblique vision. If when one eye is shut, we fix the other upon a point, such as the head of a pin stuck into a green cloth, and continue for some time looking at the pin-head, we shall see indistinctly all other objects within the sphere of vision. Let one of these objects be a strip of white paper or a pen lying upon a green cloth. After a short time, the strip of paper or pen will disappear altogether, as if it were entirely removed, the impression of the green cloth upon the surrounding parts of the eye extending itself over the part of the retina which the image of the pen or paper occupied. In a short time, the vanished image will reappear, and again vanish. The same effect is produced when both eyes are used; and when the object is highly luminous, like a candle, it does not wholly disappear, but expands itself into a mass of nebulous light, which is of a blue colour, encircled with a bright ring of yellow light.

From these results it appears that oblique or indirect vision is inferior to direct vision not only in distinctness, but from its inability to preserve a sustained vision of objects; but though thus defective it possesses a superiority over direct vision in giving us a more perfect vision of minute objects, such as small stars, which cannot be

seen by direct vision. This has been observed by se
astronomers, both with regard to faint stars and t
satellites of Saturn. When the eye is turned full upo
star or satellite, it disappears but when it is direct
another part of the field of the telescope, the luminous
will become distinctly visible. The following explan
of this singular phenomenon has been offered by S
Brewster. A *luminous point* seen by *direct vision*,
sharp line of light viewed steadily for a considerable
throws the retina into a state of agitation highly
vourable to distinct vision. If we look through the
of a fine comb held close to the eye, or even thro
single aperture of the same narrowness, at a sheet o
minated white paper, or even at the sky, the paper
sky will appear to be covered with an infinite num
broken serpentine lines, parallel to the aperture
in constant motion; and as the aperture is turned r
these parallel undulations will turn round also.
black and white lines are obviously undulations on t
tina, which is sensible to the impressions of light i
phase of the undulation, and insensible to it in an
phase. An analogous effect is produced by looking
fastly, and for a considerable time, on the parallel
which represent the sea in certain maps. These
will break into portions of serpentine lines, and a
prismatic tints will be seen included between the b
curvilinear portions. A sharp point or line of li
therefore unable to keep up a continued vision of
upon the retina when seen directly.

Now, in the case of indirect vision, we have al
seen that a luminous object does not vanish, but is

ndistinctly, and produces an enlarged image on the retina, eside that which is produced by the defect of convergence n the pupils. Hence a star seen indirectly, will affect a rger portion of the retina from these two causes, and ing its sharpness, will be more distinct.

These peculiarities of the retina with regard to vision, e, without doubt, the source of many optical deceptions, hich have been ascribed to supernatural origin. In a rk night, when objects are feebly illuminated, their appearance and reappearance must seem very extraor-nary to a person, whose fear or curiosity calls forth all s powers of observation. This defect of the eye must ve been often witnessed by the sportsman in attempting mark, upon the monotonous heaths, the particular spots here moor-game had alighted. Availing himself of the ghtest difference of tint in the adjacent heaths, he en-vours to keep his eye steadily upon it as he advances; whenever the contrast of illumination is feeble, he ost always loses sight of his mark, or if the retina does it up a second time, it is only to lose it again.

THE DURATION OF IMPRESSIONS OF LIGHT UPON THE EYE.

ery body must have observed that when we whirl a ng stick in the hand, a circle of light is seen mark-t the parts described by its burning end. As the g extremity can only be in one point of the path at ne instant, it is manifest that the impression of its ontinues some time on the eye. In like manner, the twinkling of the eye, or rapid closing of the for the purpose of diffusing the lubricating fluid

window at the end of a long apartment,
direct the eye to the dark wall. In gen
observer will see a picture of the wind
the dark bars are white and the white
the practised observer, who makes the
great promptness, will see an accurate
the window with dark bars and bright
representation is instantly succeeded by t
picture, in which the bars are bright, an
M. D'Arcy found that the light of a
at the distance of 165 seconds, maintai
on the retina the seventh part of a sec
mine after viewing a brilliant gas light
going into a dark cellar, observed a disti
trum of the gas light on the opposite
for upwards of three minutes. From th
therefore, that the effect of light upon th
for some time; and that the period of i
portionate to its primary intensity.

ow as little as why we hear one sound with two nd smell one scent with two nostrils. He consi- hat the mind is incapable of receiving two distinct sions at the same instant; and that the simple ex- nt of Heller affords unexceptionable evidence of ct, that we employ our eyes severally, and not at me instant, in distinct vision, though the interval small to be measurable.

is interesting to enquire what are conditions render vision under these circumstances single or . It is to be borne in mind that the centre of the , from whatever cause it proceed, furnishes the listinct vision. Hence, in looking at a point of an we invariably direct the axis of the eye towards it; hen we look with one eye at a succession of objects in a line directly before us, but at different dis- the optic axis is seen to incline inwards when we the nearest object, and to increase its direction is as we view those which are more remote.

e vision.—Now when we look with both eyes at of such a series of objects, it appears single, the ar double. This familiar but remarkable phe- has given rise to the hypothesis that there are ding points in either retina; it is supposed that object is delineated upon those points of the two hich are naturally associated, it appears single, e under other circumstances. But it seems un- to resort to this explanation of the fact. There that, in one sense, we really see two objects, objects appear as one, in consequence of the ng exactly the same place as the other. Single

muscles of the eyeballs, [illegible]
to any point of space at a greater distance tha
inches. When therefore it happens, that the
tion of an object is the same or nearly the sa
eyes, that object appears single; when differe
ject appears double. In both cases two objec
but in single vision they are seen in the same
therefore necessarily appear to form but one;
coincide, and are therefore essentially indist
If, for example, we look at an aperture in a w
ter, we know that an image of it is formed i
but, as the line of visible direction from any
one image meets the line of visible directi
same point in the other image, each point wi
one point, and, consequently, the whole aper
one eye will coincide with or cover the wh
seen by the other. Were anything further
prove the correctness of this theory, the p
double vision present themselves.

Double vision.—If the axes of both eyes a
[illegible] to a point wit

y raise or depress one eyeball, when the ob-
hat eye appears to shift its place, as the posi-
gan is varied. It is easy, therefore, by a very
e to render vision double. The effect which
ıced at will in an experiment, sometimes oc-
esult of disease. M. Majendie mentions the
ntleman in whom, from palsy of the third
ft eye is permanently drawn outwards; the
of which, he observes, is, that with that eye
ıees objects *in their wrong places*, "*déplacés
ıgt cinq dégrés à droite de leur position.*" The
s, but not without its parallel, and the account
of the displacement of the eye is incorrect. It
ıat the object is seen by the averted eye *out
ition*; the proof which is, that an eye thus
ıimilarly pushed aside for experiment's sake,
rue an aim as before, or look along a line as
ls a remote object. The object is seen appar-
places, yet both eyes see truly. This para-
mstance renders evident, one of the most
isions in our frame, namely, the extreme
which the two eyes are coadjusted, so that
sions may exactly tally. If the muscles of
eyes is unable to direct the two axes of the
ame point, the object will in that case also
e. This inability of one eye to follow the
he other is frequently the cause of squinting,
which is, as it were, left behind, necessarily
ferent direction from the other. The same
ı produced by the imperfect vision of one eye,
ce of which the good eye only is used. Hence

A solid object being placed so as to be
eyes, projects a different perspective figu
now if these two perspectives be acc
paper, and presented one to each eye so
responding parts, the original solid fig
rently reproduced in such a manner tha
imagination can make it appear as a re
plane surface. This and numerous o
explain the cause of the inadequacy of
sent the relief of objects, and indicate a
senting external nature with more truth
have yet been obtained.

ESTIMATION OF SIZE AND DISTAN

Every object at which we look must
visual magnitude, inasmuch as the ap
object must exactly depend upon the sp
line occupies upon the retina. Now th
different distances will, it is easily show

by Cheselden, that such knowledge is relative, and from the experience derived from the combined of the senses of sight and touch. This philosophic , after performing the operation of couching, the effect of the first visual impression upon his , which he describes in the following words:—

is young gentleman either had been born blind, or t his sight so early that he had no remembrance having seen: the blindness arose from a cataract ue crystalline lens in both eyes. Like other per- o have ripe cataracts, he was not so blind but that l discern day from night, and for the most part in g light, distinguish black, and white, and scarlet. he first saw, he was so far from making any judg- out distances, that he thought all objects whatever . his eye, (as he expressed it,) as what he felt . his skin. He knew not one thing from another, r different in shape or magnitude: but upon being at those things were, whose form he knew before eling, he would carefully observe that he might em again. Two months after being couched, his n seems to have been drawn to the effects of paint- ich he then first and at once comprehended; but en he was no less surprised, expecting the pictures feel like the things they represented, and was when he found those parts, which by their light dow appeared round and even, felt only flat like ; and asked which was the lying sense, feeling g?

ng shown a small miniature of his father, and told

seemed as impos...
pint. At first he could bear but very ...
things he saw he thought extremely large,
ing things larger, those first seen he conceiv
being able to imagine any lines beyond the b
The room he was in, he said, he knew to l
the house, yet he could not conceive that th
could look bigger. Before he was couche
little advantage from seeing worth undergo
tion for, except reading and writing; fo
thought he could have no more pleasure in
than he had in the garden, which he could
and readily; and even blindness, he obs
advantage, that he could go anywhere in
better than those who can see; and after
did not soon lose this quality, nor desi
about the house in the night. He said
was a new delight, and the pleasure was
wanted ways to express it; but his grat
selden he could not conceal, never see
... tears of joy and other mar

he same object with both eyes, he thought it looked bout twice as large as with the first couched only, but ot double that he can anyways discover."

From these details we learn, that originally we derive o information respecting either the distance or real magitude of bodies from the sense of sight, and that there is o essential resemblance between the ideas communicated y vision and by feeling. The infancy of man's existence s employed in learning to interpret the visible signs of xternal objects. For this purpose, as soon as there is inelligence in an infant's gaze, it extends its hands to touch nd examine each object in succession which attracts its otice.

The eye has no original measure for distance, and gives s no certain notion of real magnitude. When the eye is ixed upon a point on the wall of a narrow chamber, or in he vault of heaven, it seems to command an oval or circuar area of equal visual dimensions; a foot rule under these ircumstances held at the distance before the eye, measures equally the side of the room or a segment of the firmament.

When the actual size of an object is unknown to us, and we look at it, if at a certain degree of remoteness, with both eyes, *or if near, with one eye only*, we judge of its distance by the greater or less indistinctness of its outline and colour. We judge of its real magnitude by calculation founded upon its *apparent* size and probable distance. Hence we are liable to continual mistakes on these points. An Englishman, in the clear atmosphere of Italy, supposes distant objects to be nearer to him than they are. We think the moon larger when near the horizon than

differently of the distance of bodies accor
we judge correctly when they are near,
distant; then our judgments are freq
but when objects are very distant we
error.

The united actions of both eyes is ab
in judging correctly of distance, as the
ment will prove. Suspend a ring by a
hook capable of entering it easily, to the e
place yourself at a proper distance, and
the hook into the ring; if you use both
ceed every time; if you shut one eye,
hook will go too far or fall short of the
succeed only by chance and after much
sons with eyes of unequal power, do not
they use both eyes.

If a person by accident loses an eye,
be a year before he can judge correctly
bodies placed near him. In general, pe

ıe level with ourselves. It is the same objects placed above. Hence the neces- onsiderable size to objects intended to be of edifices and seen at a distance. The nsions of a body are, the nearer it must ye to be seen distinctly. We see a horse listance of "ten yards,"* but should not d at that distance. If I wish to examine r of these animals, the eye requires to be 'ever, the same object may be seen dis- fferent distances; for instance, it is in- y persons, whether they place the book eading at the distance of one or two feet the intensity of the light which illumi- as much influence upon the distance at een distinctly.

he size of bodies.—The manner in which ɔrrect judgment of the size of bodies, de- the understanding and upon habit, than paratus of vision.

judgments relative to the dimensions of ıize of the image formed at the bottom of ınsity of the light which proceeds from stance at which we supposed it placed, ım our habit of beholding similar objects. e judge with difficulty of the size of a body the first time, when we do not consider its ant mountain, when first seen, generally ıaller than it really is; hence we believe when in fact we are at a great distance.

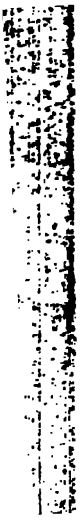
's *Physiology* translated by Dr. Forsyth.

Estimation of the motion of bodies. — We c
motion of a body by that of its image upon t
by the variations of the size of this image, c
to the same thing, by the change of the di
light which reaches the eye. For us to be
the motion of a body, it must not move to
then we should not perceive it, as happens
sent by gunpowder, especially when they
When they move at a distance from us, as t
to the eye for a long time, because the fie
larger, we easily perceive them. To judge
motion of bodies, we must not be in motio

It is difficult to observe the motions of b
tance. In fact, we judge of their motic
only by the variation in the size of the
this variation, at a considerable distance
is very difficult, or even sometimes impo
estimate it. In general, we discover wit
motions of bodies; whether this effect d
of motion, as in the

able, without some change, to see objects distinctly
ss distance. This will readily be seen by looking
n the fingers at a distant object. When the dis-
ject is seen distinctly, the fingers will be seen in-
tly; and if we look at the fingers so as to see them
tly, the distant object will be quite indistinct.
ust be evident, then, that the rays of light which
om an object at some distance from the eye, and
ssuing from a much nearer object, cannot be col-
into foci at the same given distance behind the
line lens, unless the eye have a power of altering
l length. We know, moreover, that *perfect* vision
uced, only when the focal point is situate upon the
: vision at different distances therefore cannot occur,
the eye possesses a power of focal adjustment. The
ism by which this focal adjustment is effected still
s in obscurity, notwithstanding the numerous at-
that have been made to explain it.
ious hypotheses.—I shall content myself with a very
ention of the principal hypotheses to explain the
ng action. To enumerate all with barely intelligi-
nciseness, would occupy a larger space than can
oted to the subject. It has been ascribed to a
of figure in the cornea,—to the variations in the
er of the pupil,—to a change of figure of the globe
action of its muscles,—to a change of figure of the
an action proper to itself,—to a change of place of
ns by the contraction of the ciliary processes and
mpression of the vitreous humour at its circum-
.

first supposes a close aponeurotic expansion derived



by their contraction; the fo
larity to the crystalline; and the fi
structure to the ciliary processes.

Objections to some of the hypoth
made by Dr. Young, contravenes th
change produced consists in an alt
the cornea. A convex lens fixed in
tained water, and the edges of whi
wax, was applied to the eye, so tha
half way into the socket, and was e
with the water: the eye immediatel
but upon the addition of another co
for the loss of the convexity of the c
stored to its natural state, and the ey
of adjustment.

The only evident change in the ey
focal length to different distances, is
diameter of the pupil. The pupil
tant object is seen, and diminishes
nearer point. Upon a superficial an

the correctness of hypothetical explanation is put to the test of direct experiment, it proves to be fallacious. 1st. Sir D. Brewster ascertained by direct experiment, that a variation in the aperture of the pupil, produced artificially, is incapable of producing adjustment. 2d. The following experiments of Professor Mayo may be adduced in confirmation. "A room was darkened by half closing the shutters, and I attentively observed the state of the pupil, when Mr. Robinson directed his eye to a definite point upon the optometer: the pupil was of course considerably dilated: the shutters being opened, the pupil instantly contracted, but the point upon the optometer at which the lines crossed, did not shift its place.

"When by some practice I had accustomed my own eye to the range of the optometer, I compared its range in the brightest and in the obscurest light in which the lines were visible, and observed no apparent difference in the two cases. Mr. Robinson made a similar observation. Either of these experiments prove that the change in the size of the pupil is not the means by which the adjustment of the eye to distances is effected. But an additional fact may be mentioned. In an old lady of sixty-seven, whose sight in early youth was remarkably good, but whose eyes can now only bring to a focus parallel rays, the pupil retains its mobility perfectly under variations of light, and even sensibly moves upon her making ineffectual attempts to read, without spectacles, a page held at different distances from her?"

As an elongation of the eye would alter the curvature of the retina, and consequently the centre of visible direction, and produce a change of place in the image, we

ment consist in a change of form in tl
fibres of which he describes, and which
irritable. But it does not appear from
that the crystalline possesses irritability
be attached to a single well attested c
point so delicate, the instance of Hen
by Sir Everard Home, proves that the
power of adjustment after the removal

The following inferences, which are
experiments by Sir D. Brewster on this
be most entitled to our consideration.

1st. The contraction of the pupil,
takes place when the eye is adjusted to
not produce distinct vision by the dimi
ture, but by some other action which
panies it.

2d. That the eye adjusts itself to n
actions; one of which is *voluntary*, de
the will, and the other *involuntary*,
stimulus of light falling on the retina.

mt of the variation of its aperture, it must be
y the parts in immediate contact with the base
s. By considering the various ways in which
anism at the base of the iris may produce the
it, it appears to be almost certain that the lens
ed from the retina by the contraction of the

of long-sightedness.—When the eye loses the
accommodating itself to near objects the person
hted, or *presbyopic*. This is owing to a diminu-
ie refracting power of the humours of the eye,
t account the rays of light from near objects,
tendency to diverge, are not brought to a focal
n the retina, but would, if continued on, come
t some distance behind it: while rays from dis-
cts, being more nearly parallel, are capable of
ught to a focal point upon the retina. *Presby-*
rding to some, is owing to a diminution in the
of the aqueous humour causing a diminished
of the cornea; according to others, it is due to
ical change in the state of the crystalline lens, by
density and refractive power are altered. This
kes place most frequently at a particular part in the
f the lens, and takes several months to go round.
human eye," says Sir D. Brewster, "is not
with peculiar care at this period, the change in
ition of the lens often runs into cataract, or ter-
in a derangement of fibres, which, though not
by white opacity, occasions imperfections of
at are often mistaken for amaurosis, and other
A skilful oculist, who thoroughly understands

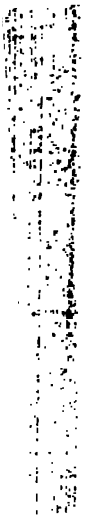
tude of the change which is going on, in a proper remedies for stopping its progress; a taining whether it has advanced to such a st can be advanced from convex or concave lens cases lenses are often resorted to before the cry has suffered an uniform change of figure or the use of them cannot fail to aggravate tl which they are intended to remedy. In dis lens, where the separation of fibres is confi spots, and is yet of such magnitude as to g coloured images of a luminous object, or irr of light, it is often necessary to limit the ape spectacles, so as to allow the vision to be p the good part of the crystalline lens.

It is easy, artificially, to obviate this defe when it is not accompanied by disease, by the of convex lenses, which, by compensating th refractive powers of the humours, enables th verge the pencils of light flowing from near o tinct foci on the retina.

etina; and having crossed, and begun to disperse again, re spread upon the retina in a circle instead of a point; nd therefore the picture on the retina is indistinct. his imperfection often appears in early life, and arises om an increase of density in the central parts of the ystalline lens, or to an increased convexity of the cornea, wing to the presence of an undue quantity of the aqueous umour. By using a suitable concave lens, the converg- nce of the rays is delayed, so that the excessive refrac- on is corrected.

OCULAR SPECTRA.

The phenomena of ocular spectra or images of lumi- ous objects remaining upon the retina after the external npression is withdrawn, are highly interesting and rious. Luminous sparks and flashes, halos or variously loured rings, it is well known, are produced at will by iction or pressure of the closed eyelids, and the first are instant effect of concussions of the brain. The red is at colour called up by the rudest artificial pressure; the olet by the slightest; and the gentlest impulse is the atural one, in which the light suffers no decomposition. re these appearances really retinal impressions, or illu- ory mental phantoms, founded on the feeble and obscure nalogy subsisting between mechanical pressure and the npression of light? Although blind persons perceive ch appearances, it is doubtful if they ever present them- lves in cases where the retina is disorganized, or after e extirpation of the eyeball, as the mutilated feel their ngers and toes. They seem therefore to establish the ssential connexion between the retina and the faculty of



...of the retina to be

Accidental colours.—If the retina the eye upon a coloured spot str some seconds, upon averting it the haunted by a spot of the size of th but of a different colour. If the e with different colours, the eye beir trial, to a perfectly white surface, th trum is found to have an invariable of the spot by which the eye has secondary colour is called the conv colour of the first.

In order to find the accidental col the spectrum, take half the length pair of compasses, and having set on whose accidental colour is required. fall upon the accidental colour. Th colours, derived from observation, ma *the accidental colour of any primitive which in the prismatic spectrum is dis tinct colour* [illegible]

of all the colours of the spectrum forms white light, it is obvious, that if one is left out, the mixture of the remainder will not be white light but some other tint. This other tint is found to be nearly that which corresponds to the centre of gravity of all the other colours which are left. So that if we arrange the colours of the spectrum in a circle, which is nothing more than the prismatic spectrum bent round till its two ends meet, we shall see that the centre of gravity of the colours which remain after one colour is omitted, must necessarily be opposite to the omitted colour, that is, the complementary colour is found in the same way as the accidental colour. Thus, if the *red* is omitted, the centre of gravity of the remaining arch will be in the blue.

With the aid of these facts, the theory of accidental colours will be readily understood. When the eye has been for some time fixed on the *red* wafer, the part of the etina occupied by the red image is strongly excited, or s it were deadened by its continued action. The sensiility to red light will therefore be diminished; and, conquently, when the eye is turned from the *red* wafer to e white paper, the deadened portion of the retina will insensible to the red rays which form part of the white ht from the paper, and consequently will see the paper that colour which arises from all the rays in the white t of the paper but the red; that is of a *bluish green ur*, which is therefore the true complementary colour he red wafer. When a *black* wafer is placed on a e ground, the circular portion of the retina, on which lack image falls, in place of being deadened, is pro-

...turned upon a whi
portion whiter than the rest, so tha
of *black* is *white*.

Such are the phenomena of acc
weak light is employed; but when
powerfully with a bright white light.
a different character. The first pe
experiment with any care was Sir
sent an account of his experiments
they were not published till 1829.
1691, Sir Isaac, having shut his le
right one to the image of the sun ref
ing-glass. In order to see the im
made, he turned his eye to a dark c
when he observed a bright spot ma
circled by rings of colours. This "p
colours," as he calls it, gradually v
ever he thought of it, it returned, an
and vivid as at first. He rashly repe
three times, and his eye was impresse
"that whene...

left eye, I could see the spectrum of the sun almost as plain as with my right eye." The effect of this experiment was such, that Sir Isaac durst neither read nor write, but was obliged to shut himself completely up in a dark chamber for three days together; and by keeping in the dark, and employing his mind about other things, he began, in about three or four days, to recover the use of his eyes. This subject has been still further investigated by Æpinus; and since then Sir D. Brewster, who examined the brilliant image of the sun's disk formed by a concave reflector. With his right eye tied up, he viewed this luminous disk with the left through a blackened tube, to prevent any extraneous light from falling upon the retina. When the retina was highly excited by this intense light, he turned his left eye to a white ground, and perceived the following spectra by alternately opening and shutting the eye.

Spectra with the left eye open.	Spectra with the left eye shut.
1. Pink surrounded with green.	Green.
2. Orange mixed with pink.	Blue.
3. Yellowish brown.	Bluish pink.
4. Yellow.	Lighter blue.
5. Pure red.	Sky blue.
6. Orange.	Indigo.

Upon uncovering his right eye, and turning it to a white ground, he was surprised to find that it also gave a coloured spectrum, exactly the reverse of the first spectrum, which was pink with a green border. The reverse spectrum was green with a pinkish border. This experi-

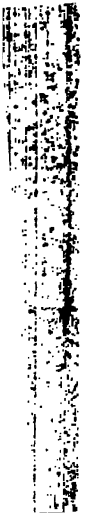
from the left to the ...

The phenomena of accidental colours are when the eye has not been strongly imp particular coloured object. It was long M. Meusnier, that when the sun shone t quarter of an inch in diameter, in a image of the luminous spot was *green*. every person must have observed, in a room illuminated by the sun, that the pa object on which the coloured light does the complementary colours. In order to phenomena, the following method app and the best. Having lighted two can one of them a piece of coloured glass, su and remove the other candle to such a two shadows of any body formed upon paper may be equally dark. In th shadows will be *red*, and the other effect may be seen in looking at the reflected from the water in a blue fin

...ellowish ; but the

by the primitive colour. A new theory of accidental colours is therefore requisite, to embrace this class of facts. The following is suggested by Sir D. Brewster.

"As in acoustics, where every fundamental sound is actually accompanied by its harmonic sound, so in the impressions of light, the sensation of one colour is accompanied by a weaker sensation of its accidental or harmonic colour. When we look at the *red* wafer, we are at the same time, with the same portion of the retina, seeing green; but being much fainter, it seems only to dilute the red, and make it as it were whiter, by the combination of the two colours. When the eye looks from the wafer to the white paper, the permanent sensation of the accidental colour remains, and we see a *green* image. The duration of the primitive impression is only a fraction of a second; but the duration of the harmonic impression continues for a time proportional to the strength of the impression. In order to apply these views to the second class of facts, we must have recourse to another principle; namely, that when the whole or great part of the retina has the sensation of any primitive colour, a portion of the retina, protected from the impression of the colour, is actually thrown into that state which give the accidental or harmonic colour. By the vibrations probably communicated from the surrounding portions, the influence of the direct or primitive colour is not propagated to parts free from its action, except in the particular case of oblique vision formerly mentioned. When the eye, therefore, looks at a white spot of solar light, seen in the middle of the red light of the curtain, the whole of the retina, excepting the



white circular spot green.

Colours produced by the unequal eyes.—A very remarkable phenom lours, in which the eye is not ex colour, was observed by Mr. Smit bers. If we hold a narrow strip of about a foot from the eye, and fix b ject at some distance beyond it, so paper double, then if we allow the the light of a candle to act strongly without affecting the left, which m from its influence, the *left* hand s seen of a bright *green* colour, and t of a *red* colour. If the strip of pape to make the two images overlap each ping parts will be perfectly white a which proves that the red and green When equally luminous candles are the two strips of paper will be white dle is held near the

tain colours of the spectrum. Various cases have been described, in which persons capable of performing the most delicate functions of vision, are unable to distinguish particular colours, and what is very remarkable, this imperfection runs in families. Mr. Huddart mentions, in the *Philosophical Transactions* for 1777, the case of Mr. Harris, a shoemaker at Allonby, in Cumberland, who was unable from his infancy to distinguish the cherries of a cherry-tree from its leaves, in so far as colour was concerned. Two of his brothers were equally defective in this respect, and always mistook *orange* for *grass green*, and *light green* for *yellow*. Harris himself could only distinguish black and white. Another case of a Mr. Scott is described by himself in the *Philosophical Transactions* for 1778; he mistook *pink* for a *pale blue*, and a *full red* for a *full green*. All kinds of yellows and blues, except sky blue, he could discern with great nicety. His father, his maternal uncle, one of his sisters, and her two sons had all the same defect. Mr. Harvey has described, in the Edinburgh Transactions, the case of a tailor, at Plymouth, whose peculiarity consisted in distinguishing with certainty only white, yellow, and grey: the solar spectrum he regarded as consisting only of yellow and light blue. He regarded indigo and Prussian blue as black. Mr. R. Tucker, son of Dr. Tucker, of Ashburton, mistakes orange for green; he cannot distinguish blue from pink, but always knows yellow. He describes the colours of the solar spectrum as follows:

1. Red . . . mistaken for . . . Brown.
2. Orange . . „ „ . . . Green.

6. Indigo . . „ ..
7. Violet. . . „ „ . .

Sir D. Brewster describes the case of a
the prime of life, who saw only two colou
trum, viz., *yellow* and *blue*. Whenever
the spectrum were absorbed by a reddish g
red and dark green, he saw only one colo
or orange, which he could not distinguis
middle of the red space was absorbed by a
saw the black line with what he called
each side of it.

Our illustrious countrymen, Mr. Dug
Dalton, and Mr. Troughton experience t
to distinguish certain colours.

In almost all these cases, the differ
lours have the power of exciting the s
and giving a distinct vision of objects,
case of Dr. Dalton, who is said to be s
the red extremity of the spectrum.

In these various cases, the persons

iating exactly those differences between rays on their colour depends. Should all these supposi- rove incorrect, we must, for the present, content es with supposing that the retina is insensible to lours at one end of the spectrum, just as Dr. Wol- has proved the ears of certain persons to be in- le to sounds at one extremity of the scale of mu- otes, while they are perfectly sensible to all other .

VISION AT DIFFERENT AGES.

e eye is one of the first parts formed. In the fœtus ppear as two black spots; at seven months they pable of modifying light, so as to form an image the retina; till this period the eyes could not fulfil rposes of vision, because, till then, the pupil is by the membrana pupillaris. At seven months embrane disappears; it is commonly said to split, obably is absorbed. This too is the time when the can live. Fœtal eyes, however, are found, which , or even five months, offer no trace of this mem- .

ere are some differences between the eye of the and adult, but they are not very remarkable. ne fœtus the sclerotic is finer, and even slightly arent; the choroid is red without, and the black f its inner surface is less intense; the retina is pro- nably more developed; the aqueous humour is more lant, whence a greater projection of the cornea; , the crystalline is far less consistent than in the

...es, till the adult period
in a more striking manner. T
ticularly evident in old age. The
particular becomes not only more
a yellow colour, at first clear
While it undergoes this change
hardness, and contracts a slight o
ceed with age till it amounts to a c

The eye therefore is well adap
infant, to act upon light, and ima
the retina, as experience demonstr
ing the first month, the child gi
sensible to light; its eyes move bu
uncertain manner; it is not even til
week that it begins to give proofs of
liant light only is at first capable of
ing it; it seems pleased with lookin
becomes sensible to the mere light
yet, however, distinguish any obj
strike it are red; and in general it

especially by the conclusions, which the continual errors into which it falls, compel it to draw, its sight becomes perfected really by education.

Infants have been thought to see objects double or reversed; this, however, is clearly erroneous. It is also said, and with more reason, that as the refracting parts of the eye are more abundant, they ought to see objects smaller than they in fact are.

Vision soon acquires all the perfection of which it is susceptible, and in general undergoes no modification till towards the commencement of *old age*. Then it is that the change above mentioned in the humours of the eye tends to render it less distinct; but what renders it still weaker is the diminution of the sensibility of the retina.

Three causes combine to alter vision in the old man; first, the diminution of the quantity of the humours of the eye, a circumstance which, by diminishing the refracting power of the organ, makes the old man no longer able accurately to distinguish near objects. Secondly, the commencing opacity of the crystalline lens, which disorders vision, and tends, by increasing, to produce blindness, causing the disease known under the name of cataract. Thirdly and lastly, the diminution of the sensibility of the retina, or if you please, of the brain, which opposes the perception of impressions produced upon the eye, and leads to complete and incurable blindness.

OF

DISEASES OF THE EYE.

In treating of the diseases of the eye, I shall
same order which I adopted in describing its
and proceed to describe, first, the diseases of
appendages; secondly, those of its orbitar ap
thirdly, the inflammation of its membranes, an
sequences of such inflammation, beginning ext
proceeding inwards; fourthly, the various a
the humours; and lastly, the various acciden
the eyeball is liable, and certain malignant
the eye which render its extirpation necessary

CHAPTER I.

THE FACIAL APPENDAGE

SECTION I. CATARRHAL INFLAMMATI
CONJUNCTIVA.

ce, red, hard, and extremely painful. The mucous face of the lids is unnaturally red and vascular, and it umes speedily a thickened and villous character, re- ibling, when the lids are everted, nearly the appear- e of red velvet. The pain is very great, particularly en the lids are moved, for then the inflamed surface s against the globe of the eye, and if the membrane ering that is also inflamed, which is not unfrequently case, the pain is so severe that the patient keeps the closed, and carefully avoids all attempts at moving or ning them. On the inside, a feeling of stiffness and ness is experienced, as if the lids would not move ly over the globe, for the secretion of the mucous nbrane is, in the first instance, suppressed; but that asiness soon gives way, because the secretion is in fact eased in quantity, and becomes somewhat altered, as- uing an opaque whitish yellow appearance, approach- to that of a purulent fluid. The glands which are ated on the external surface of the inflamed mem- ne, participate in the inflammation, and the secretion n them is either suppressed or altered in its quality, so ; the edges of the lids become agglutinated during p, occasioning considerable difficulty in opening them n the patient awakes in the morning. Such are the ptoms of the early inflammatory stage.

Treatment.—Antiphlogistic measures are necessary in e cases. Apply leeches to the eyelids, and lotions and l unctuous remedies to the margins of the lids at nt to prevent them from sticking together, resorting to such internal means as the state of the patient r require.

SECTION 2. PSOROPHTHALMY.

Psorophthalmy is an inflammation particularly of that part of the conjunctiva which lines the lids, but it extends sometimes over the whole of the conjunctiva covering the globe. This complaint is often obstinate, and extremely difficult of cure: it extends over the cornea, conjunctival lining of the palpebræ, the cheek and nose; and, lastly, the globe of the eye becomes affected, if this complaint be not checked. At the origin of this disease, there is a glutinous matter secreted on the edge of the lids; ulcers form: and there is often great difficulty in separating the lids from one another. By this means matter lodges on the lids, and tends to keep up the irritation of the whole of the part. You not unfrequently see the redness extending down the whole of the cheek, and excoriation taking place on the cuticle.

If the inflammation spreads over the whole of the conjunctiva, the lachrymal sac becomes irritated, and effusion of tears over the cheek takes place on the surface of the cheek. The inflammation is of the atonic kind, accompanied with that symptom distinguishing strumous ophthalmia, intolerance of light, and a sensation as if there were some extraneous body in the eye, grit or sand, which gives rise to an effusion of the tears. The lids are very red on the edges, and there is an incrustation of matter on them. There is occasionally a contraction of the integument of the lower lid, by which it becomes depressed and everted. In this inflammation, the secretion deposited from the lids dries up, ulcers form, small brittle incrustations are formed, and there is an appearance

tinea on the lids. The watery part of the secretion from the lids is evaporated, which leaves the incrustations that keep up the irritation and form small ulcers.

In consequence, an alteration in the figure of the tarsi occurs: there is a contraction of the cellular membrane just beneath the lower palpebra, and eversion of that lid. This affection of the eye is of difficult management, and is frequently found in persons of a scrofulous diathesis, in children of large towns who are ill fed and worse clothed, with little attention paid to cleanliness. The complaint is very obstinate in its cure: and if relieved, it generally returns, and becomes as bad as ever. It is not, however, confined to the lower classes, but the higher and middling ranks of society are sometimes attacked with it—those who are of a scrofulous diathesis. In schools also it will be found: it frequently arises from the irritating matter being applied to the lid, which may be conveyed from one to another by using the same towel, or in some such way.

The *treatment* of this complaint does not essentially differ from that of the strumous: it is an inflammation without power, one of the atonic kind. Depletion must not be pursued to any extent. It will be right when any symptoms of irritation are present to remove them by the application of leeches, and opening the bowels. Drastic purgatives must not be exhibited, as they do not answer the object which it is intended to effect: mild aperients, combined with mercurial medicines, such as calomel, the hydrargyrum cum creta, or the blue pill, and in quantities so as to give tone to the system. When any febrile excitement that may have existed is removed, begin with

tonic remedies: that is, when the skin
feel, and the tongue is clean, and the secr
bowels are regular in their quantity and q

The applications to the part should
stimulants, and the best form in which
hibited is that of ointment. The briny i
the edges of the lid, and which are secrete
bomian follicles, confine the lids so closel
in the morning when the patient awake
appearance of being glued together. Th
duce increased irritation on the edges o
To prevent this, the lids are to be besm
ointment. The one commonly used is
citron ointment, the unguentum hydrarg
it cannot be well borne of the usual stren
fore is diluted with one-third, or one-h
more than this, of unguentum cetacei, an
with a camel-hair brush twice a day, the
matter being carefully washed off before
and then some of the ointment is to be l
the edges. The unguentum hydrargyri
used for the same purpose. In fact, an
stimulating mercurial ointments will do
tion will be required to be varied, and
strength must be regulated by the effect o
use of the vinum opii will be attended wi
sults, and the application of blisters will
sally good effect.

In the use of blisters, however, in th
well as in strumous ophthalmia, no ad
derived from keeping them open; for wh

they are apt to give rise to fresh irritation. Therefore, after the application of a blister, you should desire it to be healed; and, if necessary, direct a fresh one to be applied. By this means the irritation in the eyes will be relieved, and their employment be attended with advantage.

SECTION 3. LIPPITUDO.

In instances where inflammation of the palpebræ has frequently occurred, more particularly in old persons, and those in whom the skin is very thin,—in whom the margins of the palpebræ have become much attenuated and very red, the hair of the palpebræ is lost, so that the edges of the lids have a rawness, which extends to a considerable distance, presenting a very unpleasant appearance; this is particularly the case with respect to the lower lid, the whole external surface of which is sometimes raw and excoriated. This state is called *lippitudo*, and occurs very frequently in old persons, particularly where the eyes have been exposed to smoke or acrid vapours, and where the individual too often excites the mucous membrane of the alimentary canal by unwholesome food. It has two stages; the first is a simple excoriation; the second, an ulceration of the border of the palpebræ. In the chronic form of this affection, in strumous subjects, the conjunctiva is greatly thickened, indurated, and altered in its texture; the ciliary glands are destroyed, together with the fine cuticle of the lid, to some extent beyond the ciliary margin; and a partial eversion of the lids, owing to the tumified state of the conjunctiva, increases the deformity. The mouths of the meibomian *glands* are obliterated, and the ducts plugged *by their inspissated* secretion; sometimes the conjunctiva

fungates, so as to render the eversion complete process of cicatrization renders it permanent.

Treatment.—In lippitudo, we must first, if any appearance of active inflammation, adopt th most calculated to remove that; then mild stir and astringent remedies applied to the surface of lids, are the most successful. These have the bringing the excoriated mucous margin of the eye a better state, and also of exciting a more healt tion from the meibomian glands, and will very restore the edges of the palpebræ to their sound tural condition. The *unguentum hydrargyri ni* citron ointment, is perhaps the most favourable re this purpose. This may either be employed of strength, or diluted with spermaceti cerate. surgeon's own hands it is best to employ it un the milder form alone should be entrusted to oth applying this remedy, it is necessary first to soft fore the fire and then to apply it by means of a ca pencil to the diseased surface, care being taker does not extend to the mucous surface of the eyel to reach the eye itself. The *red precipitate* ointm be employed in a similar manner, but it must be the pharmacopœial strength. Other forms of have been proposed, but they are all inferior to t mentioned. The lead and zinc ointment, or one c with opium, will often agree with those slight, irritable lippitudos sometimes met with; but sc even cetaceous ointment is disagreeable and affor lief: in this case hot water is most agreeable and ing to the eye, at a temperature which is not endu *the hand.*

In chronic lippitudo, the ducts, which are distended, should be opened, and the white consolidated secretion should be removed, the conjunctiva should be occasionally scarified, and the meibomian borders stimulated by one of those ointments already mentioned. The tarsal edges should also be frequently bathed with an astringent lotion. In obstinate cases, where the conjunctiva is altered in texture, the sulphate of copper carried over the thickened conjunctiva and ulcerated border of the tarsus is very useful; nitrate of silver, sulphate of copper or zinc, or bichloride of mercury in solution applied, with a camel-hair brush, to the tarsal edges previous to the application of the ointment, are also very useful.

SECTION 4. HORDEOLUM.

One of the most common affections of the eyelids is that known by the name of *stye*, or *hordeolum*, from its resemblance to a barley-corn. It consists of a small abscess in the lid, and is produced by an obstruction in the follicles of Meibomius; the secretion from the part is altered, becomes inspissated, lodges on the lid, excites irritation, inflammation, and the process of suppuration; lastly, the small abscess breaks, and matter is discharged. In most instances the suppuration is confined to a small space, but in others it puts on the character of a boil, and sloughing of the cellular membrane then takes place. Some persons are more prone to this disease than others; it frequently appears in those who have been subject to disorder of the digestive organs, or in those of a scrofulous habit of body, and young persons. This morbid affection would be of little consequence in itself, but for

—excoriation of the skin of the face, —pp—
break out; the cilia become altered in the
turned inwards on the globe of the eye; a
different states a tendency to chronic ophth
up.

Treatment.

It is necessary when styes are attended w
tion and redness, that cold applications, po
mentations should be applied, as in ot
tions; and when matter is formed, th
should be opened with a lancet. But it m
happens that this affection depends upon so
in the system, on derangement of the dige
impaired functions in some part of the b
these states must be attended to, for they
tion, and sometimes ulceration of the edge
The best local applications that can be n
those of a mild stimulating nature, the
menta, with a little of which the edges

is not essential what kind is employed, if it be mulating.

SECTION 5. TINEA CILIARIS.

ea ciliaris is a disease of the ciliary foveola, and ommonly combined with lippitudo. It occurs inflamed, thickened margins of the eyelids, as rs, not unlike the pustules of porrigo, formed e orifices of the cilia. The porrigo or crustea rspreading the eyelids and cheeks, with chaps tions behind the ears, and within the meatus au- re concomitant affections, especially in children.

Treatment.

fection in its active stage must be combated by ntiphlogistic means. When the inflammatory are gone by, the re-establishment of a healthy al surface and a healthy meibomian secretion, are s to be attempted. Cleanliness is of the first im- and indeed more depends upon the patient than n in the cure of these affections. The margins , and the roots of the ciliæ should be thoroughly rom loose scabs and branny incrustations. Then ch the surface, that is ulcerated, with nitrate of epeat this application once in two or three days, e intervals, smear the edges of the eyelids once day with the citron ointment, previously softened

SECTION 6. TRICHIASIS.

r *affection to* be described is that known by the

not owing to the effect of the altered growth of only, but to a turning in of the lids, called *entrop*

SECTION 7. ENTROPIUM.

Entropium, or inversion of the eyelids, is from ulceration of the tarsi, the cicatrices forme healing of lippitudinous ulcers which alter the the lids, so that the eyelashes are turned inwa tate the conjunctiva, and produce a continual sti tation of the whole organ. There is a watering c together with chronic ophthalmia, and in a short sels may be seen shooting over the cornea; nebula ation of the cornea supervene, and thus a serio irritation of the transparent part of the eye is

Treatment.

Where the affection is simple trichiasis, means that can be relied on, is to pluck aw lashes; some benefit may be derived from [illegible] plaster to the lid, which is to

n drawn upwards. The mode of performing the ope-
on is very simple; lift a portion of the skin of the af-
ed lid with a pair of forceps which have transverse
ches at the points, and these grooved transversely;
i this lay a firm hold of the portion of the lid, take a
of curved scissors, and cut off the projecting portion,
ar to the edge of the lid as you can.

SECTION 8. ECTROPIUM.

tropium, or eversion of the lids, happens from ulcer-
i on their edges, an altered and vitiated secretion
the follicles of Meibomius, which produces a red-
and an altered state of the conjunctiva, and from
rices and contractions of the skin of the lids, which
to evert them. This complaint is very distressing to
atient; the eye has not its natural covering; irrita-
from extraneous bodies getting into it, is produced,
hus a constant state of chronic ophthalmia is kept up.

Treatment.

hen the disease is brought on by a thickened state
e conjunctiva lining the lid, that portion must be
ved; if from a cicatrix, it must be divided; but
seldom answers; the divided cicatrix again con-
i, and the disease returns. The plan usually adopted
sts in removing a triangular portion of the lid, just
e same way as the operation for cancer of the lip is
rmed; by cutting through a piece of lid which is
l by a pair of forceps, so that the base shall be to-
s the edge of the lid, and the apex below, at the
i *of the two sides.* A suture is applied through the

Various small tumours are often to be n
lids, such as encysted tumours and others.
require no particular plan of treatment
those in other parts of the body, little nee
them. In their removal, one thing mu
mind, viz., the importance of the organ in
hood of which they are situated, so that in r
no injury is done to so delicate a structure

SECTION 10. ENCANTHI

This consists in an alteration of the s
caruncula lachrymalis, and neighbouring
of the conjunctiva. The caruncula is e
commencement it has a granulated appe
loses as it increases, and then becomes sii
nut, being ash-coloured, and streaked wi
sels. This enlargement or excrescence
from closing, and allows extraneous n
which keeps up inflammation of the e

the lid, by taking up the tumour with a pair of forc
ves it with a pair of curved scissors with convex edg
en this complaint has not assumed the malignant for
always remediable by excision. Never operate, ho
, when the encanthis has become of the malign
l, and put on the cancerous appearance. This wi
nown by the dull red colour of the excrescence, it
ssive hardness, lancinating pains extending to th
all and forehead, particularly when touched; fou
rs, with irregular edges, having all the appearance of
er in any other part of the body.

SECTION 11. PTOSIS.

permanent drooping of the upper eyelid without any
rsion of the cilia, or inflammation, occasionally takes
. It is, for the most part, a symptomatic disease,
ently accompanied by some form of paralysis, or con-
nt on apoplexy. It may either be *congenital*, or de-
nt on *atony* of the lid generally, or on *paralysis*.
treatment will vary with the cause: if it be *con-*
, or dependent on *atony*, the removal of a portion
integument by the knife will most probably re-
the deformity; but if it depend on paralysis, its
l will then depend on general treatment, which
its object the relief of the sensorium.

CTION 12. WOUNDS OF THE EYELIDS.

ds of the eyelids are neither dangerous nor diffi-
ire; they merely require to be treated by those
les which regulate the practice of surgery in
ts. *Penetrating* wounds of the eyelids, whether
or perpendicular, will, *generally*, require th

canal is divided, it is doubtful in what [illegible]
such a manner as to render it pervious. T
eyelids are very seldom productive of defe
amaurosis, unless some injury has, at the s
done to the eye itself.

SECTION 13. FISTULA LACHRY

By this term is understood all obstruct
chrymal passage preventing the natural fl
and mucus from the eyes to the nose.
mon cause of this complaint is a closure
puncta, and then there is *epiphora*, or a
eye, together with suffusion of the tears,
surgeon to the discovery of the cause. Thi
tured by a small sharp pin, made of gold
is to be pushed through it to the lachrym
struction is removed and the epiphora reli

When the epiphora continues, the eye be
a drooping of the lids comes on, and an
the lachrymal sac is produced. The

canal; this disease terminates fatally, and if removed it returns; in this complaint the flow of tears is a very unimportant symptom, compared with the original disease which gives rise to it.

But sometimes there is inflammation of the bones of the nose, or periosteum covering them, and the membrane lining the duct, which is thickened, and then the duct becomes more or less obstructed. It not unfrequently takes place in persons of a scrofulous habit, and those who are subject to affections of the covering of the bones. It is also sometimes a consequence of the abuse of mercury.

Fistula lachrymalis may be divided into three stages:—1st. Where there is only simple distension of the lachrymal sac. 2dly. Where there are inflammation and suppuration of the sac. And the third stage is that in which there is a fistulous opening leading from the sac to the cheek.

Simple distension of the lachrymal sac.

The first symptom which leads the patient, in this stage, to observe any thing amiss with the eye, is, that on reading or exposing it to the wind, there is a watering of the eye; in a short time, this becomes constant, and then a swelling appears at the inner corner of the eye, arising from distension of the lachrymal sac, the tears collecting in it. These produce irritation; mucus and purulent matter is secreted; but when the sac protrudes, pressure made on it pushes the tears or mucus either through the puncta, over the face, or down the nose. The complaint sometimes remains in this stage for many years (pressure being occasionally made on the sac to

excited, and ...

Inflammation and suppuration of the lachrym

This affection is attended by a puffiness of corner of the eye, redness of the surrounding sk becomes swollen and hard, from the effusion Suppuration having commenced in the sac, comes on, and the matter effects an external op which it is discharged. Now obstruction, infl and suppuration do not always take place in th the *ductus ad nasum*, from ordinary causes ; b gress of the complaint, when arising from or from specific causes will be different. An ope thus made in the sac, it is rendered permane open, by the flow of pus and tears out of the the cheek ; the disease then arrives at the thi

Fistulous opening from the sac to the c

In this stage of the complaint, the patient a good deal by frequent returns of inflammat

iting irritation in those cases where there is simple ension of the sac. One cause of this complaint i vitiated state of the follicles of Meibomius: when ter is secreted, and the eyelids are closed together, irritation is thus produced in the lachrymal sac—in ie cases, the lids should be washed with tepid water, besmeared every night at bed-time, with a little of unguentum hydrargyri nitratis. By this means, and nding to the constitution, and removing irritation t arises, the patient may remain in that state for s.

When the obstruction is complete, the distension conrable, the attacks of inflammation frequent, and supation has commenced, another kind of treatment must dopted: in this stage the object of your treatment be to effect a natural passage for the flow of the tears, is, through the nasal duct, instead of their flowing the face. Anel was the first who attempted to procure ssage for the matter and tears into the sac, when the ıral one was obstructed; and this he did by introduca very fine probe through one of the puncta and the rymal sac to the *ductus ad nasum*, and thus dilated stricture; but the instrument was so flexible and , that it was ill calculated to overcome the obstruc-. Mr. Travers, who has had most extensive opporities of watching the progress and trying the effect of erent treatments in this disease, recommends the use n instrument of this kind; it is, however, somewhat erent; it is more nail-headed, and not of the same exling fineness, being more effectual for removing the ruction. Anel likewise constructed a small syringe, *mouth of which* was to be introduced into one of the

of duct, but [illegible]

Mr. Wathen recommended that a hollow met should be introduced into the *ductus ad nasum* ject of its being hollow was to allow the passag through it, but it was found inadequate; it soc filled with mucus. M. Dupuytren was in the using a gold tube in this way, and it is said th his cases were cured; this, however, is doubt Pott also advised the use of bougies for rem obstruction. The plan laid down by Mr. Ware now generally adopted; it consists of introduc headed style into the *ductus ad nasum*, and le main there. The style should be just large enou of the flow of tears by the side of it. If no c been made from the repeated inflammation, t be adopted in making one is as follows: direct to be seated, and then standing behind him, pas round the patient's head, open the lachrymal s carry a blunt pointed bistoury inwards and and divide the obstruction; the instrumen

[illegible] is a phymosis k

ne first week ; and to be washed ; sometimes there irritation produced by its introduction : but in there is none, and the comfort the patient ex- is very great ; the water ceases to flow over the he sight becomes stronger—the tendency to in- on is obviated ; and, indeed, so much comfort is ced, that the patient is loth to dispense with the e style.

igh the relief obtained from this plan is great, yet of treatment has been decided on which gene- ves successful ; for this mode must be considered the light of a palliative than a curative remedy ; ruction frequently returning when the style is . It sometimes happens that from disease about s of the nose, a fistulous opening from the sac to is formed. If an operation should be determined ch a case, a sharp pointed instrument must be ed, either a probe or trocar, through the fore he os unguis into the nose, and the only point mains is to keep open the perforation by a sponge nail-headed style ; but it becomes rarely necessary m this operation.

CHAPTER II.

SES OF THE ORBITAR APPENDAGES.

SECTION I. ABSCESS.

is sometimes forms within the orbit, and previous scharge occasions an equal protrusion of the globe,

returns after the discharge of the abscess, removal of pressure. If the formation c be prevented, the free discharge of it s by keeping the external orifice freely op has gradually contracted and closed. If t have formed in the cellular texture and p and supporting the eyeball, the cure will out any deformity; but if it should b the periosteum lining the orbit, it w found to give rise to very troublesome c often to deformity by causing an eversi fected by the disease.

SECTION 2. FATTY AND ENCYST

Tumours of various kinds occasion orbit. Some are compact, and consist others contain a mixture of liquid and or a limpid and sanious fluid. When t below, or to one side of the eye, they

When the tumour is posterior to the eyeball, or connected with it, it can scarcely ever be removed, unless the eye be extirpated at the same time,—generally the most advisable step, as the eye will, in most cases, be either useless or disorganized. Tumours sometimes form beneath the periosteum of the orbit, giving to the touch a firm resistance: such cases are always unfavourable, seldom curable.

Polypi of the frontal, sphenoid, and ethmoid sinuses, in their progress burst through the ethmoid and lachrymal bones, and sometimes extrude the eyes, so as to occasion the most horrible deformity: in such cases, an operation offers the only, though doubtful, remedy. Exostoses of the orbit rarely occur.

SECTION 3. ANEURISM IN THE ORBIT.

The looseness of the connecting texture in the orbit, and the number and tortuosity of the vessels, seem to predispose to that disease of the arterial and venal extremities, which gives origin to peculiar vasculo-cellular tumours, the precise nature of which is not yet satisfactorily ascertained; combining, as they do, the structure of nævus, with the more formidable character of aneurism. Two cases of this disease are recorded, in both of which the carotid artery was tied with complete success.

SECTION 4. EXOPHTHALMOS.

A protrusion of the eyeball not only accompanies tumours, when of a large size, but takes place from other causes. The simplest form is, when the protrusion takes place in consequence of inflammation, which on subsid-

state of the bowels, and by good air and
swelling should degenerate into a scir
tirpation of the whole contents of th
only, although doubtful, chance of r
relates the history of two cases of exo
hydatid of the lachrymal gland.

SECTION 5. DISEASE OF THE LAC

The lachrymal gland is subject to si
enlargement, to suppuration, and to
glands of similar structure. Its enla
by the lobulated appearance of the t
stretching the skin of the projected li
rates in children, and occasions an
above the upper eyelid, depressing t
globe so as completely to conceal it.
conveniently opened and discharged b
a narrow curved bistoury. Mr. Tr
gland, in a state of true scirrhus, f
middle aged man, with success. The

CHAPTER III.

INFLAMMATION OF THE CONJUNCTIVA.

ECTION I. SIMPLE INFLAMMATION OF THE CONJUNCTIVA.

HIS may be divided, like other inflammations, into acute id chronic. The symptoms of inflammation of the conınctiva do not differ from those of inflammation of other ırts of the body, except in so far as they are modified by ıe structure of the part, and by the function of the organ. ıdeed the change which takes place in inflammation of ıe conjunctiva may be regarded as a very beautiful inance and illustration of the change which takes place r the process of inflammation in general.

Inflammation of this organ may exist in various deıes, from the slightest degree of excitement up to inımation of the most violent and intense character.

The first symptom is redness of the part: which is very arkable, because the blood naturally conveyed by the ɜls to this part is colourless. Under any existing ıtion, the vessels are distinctly observable, and beinjected by red blood. When the irritation con-ɜ, the vessels become still more apparent, and at ı all the interlacements and anastomoses of the ı of the conjunctiva partake of the inflammation, esent almost one uniform appearance of redness. ; this time more or less pain is experienced; at the vessels become filled, an uneasy sensation is is increases, and at length, upon the admission of sharp *lancinating* pain is experienced; the patient

creasing, and at length the patient ...
heat, and a sensation as if some extraneous bo
lodged in the conjunctiva: a sort of grating betw
conjunctiva and the lid. At this time the admi
the least light or air produces such lancinating pa
the eye is spasmodically closed. During the first
the inflammation there is a more abundant secr
tears, and this generally increases, until there is
stant flow of water from under the lids.

It sometimes happens that, at the highest
excitement, this increased secretion is sudden
nished, and there is a preternatural dryness of t
producing painful sensations. A considerable
swelling takes place; the conjunctiva becom
from the increased quantity of blood admitt
vessels, and effusion follows. Although the s
pretty equally diffused over the whole surface o
junctiva, it seems to be the greatest at the trans
nea, because here the membrane is more firmly
The conjunctiva is here elevated in a circula

take of the pain; there will be a shooting pain in the maxillary bone, or more deeply seated in the head; these pains are in some instances extremely violent. This train of symptoms is attended with a greater or less degree of constitutional irritation. The patient complains of great lassitude, prostration of strength, chilliness, or rigor followed by heats. His skin will often be hot and dry, and his pulse quick and hard; his stomach will be affected, and nausea or vomiting produced; he will often complain of pain in the back, and in short of all the symptoms which indicate a considerable fever of the sympathetic kind, arising from local irritation.

The degree in which these symptoms occur will of course vary according to the constitution of the patient. In young and robust persons there will often be a high degree of local inflammation, without much constitutional irritation; while, on the other hand, in delicate and irritable patients, a much less, nay sometimes a very trifling degree of local inflammation will be accompanied with violent symptoms of constitutional derangement. Accordingly, although, *cæteris paribus*, the degree of constitutional irritation will be proportional to the degree of local excitement, this principle will be so much modified by the particular constitution of the patient, that in cases where, from the violence of the inflammation, much constitutional derangement might be expected, very little will occur; and *vice versa*, where, from the slight degree of local excitement, very little might be expected, it will sometimes happen that a great degree of constitutional irritation will attend it.

So much for the symptoms of ophthalmia, as existing

this inflammation may exist, but it is not necessary to umerate them more at large. The principal causes are, ie admission of any extraneous body and variations of mperature, especially if accompanied by intense heat id light, or partial exposure to draughts of cold air.

The chronic stage.

The term *chronic* is not, as its etymology would indi-e, applied merely with reference to duration of time; is not only applied to signify that state of conges-n and debility of vascular action produced by the te stage, but it is also applied to that state of inflam-tion which from the commencement has a character of ny and debility. As this is the more frequent form in ich this inflammation occurs, whether primary or fol-ing the acute stage, it is necessary to attend particu-r to the symptoms by which it is distinguished, as the e of treatment is very different from that which is re-ed in acute inflammation.

ie symptoms of chronic differ from those of acute in-nation of the conjunctiva rather in degree than in ; so that after they have existed for some time in acute stage, the disease gradually passes into the ic stage. The redness will be less intense, the pain accompanied it less acute, the intolerance of light e less, the chemosis and swelling will be diminished, fusion of tears less considerable, the constitutional ion will in a great degree have subsided, and, in all the acute symptoms will be much mitigated. will still, however, remain a considerable degree tability in the eye on exposure to light; some re-

...e causes of chronic inflam
predisposing, are very similar t
tion, and indeed one form very
other; but, at the same time, it
there are many causes which ter
mation, accompanied with atony
outset, which distinguish it from
nic inflammation of the conjun
place, where the patient has for
ing under disorder of the digesti
have this form of the inflamm
dyspeptic symptoms; such as un
biculus cordis; distension of th
flatulence, disagreeable tastes in
or putrid; furred tongue, and ot
derangement of the digestive or
this kind is very apt to arise from
exposure to acrid fumes or smol
It is not unfrequently the concor
measles, or small pox; it some...

cure, however, is by no means to be depended upon, and we ought on no account to neglect or relax in the proper mode of treatment, from any reliance upon such a cure; because simple inflammation of this membrane may lead to inflammation of the deeper-seated tunics of the globe of the eye; suppuration may be induced, the organ may at length become permanently disorganized, and the sight of the eye irretrievably lost. The consequences of inflammation of this membrane are very similar to those of inflammation in other parts of the body. It sometimes terminates in effusion, the serum or blood under the conjunctiva rising in a roll above the transparent cornea. It sometimes produces the adhesive process; and when it terminates in this manner, the adhesive matter is deposited under the conjunctiva, which covers the transparent cornea, and is recognized by a hazy appearance at the part. The adhesion is various, both in its extent and quantity; it is sometimes so slight as only to produce a simple clouded appearance over a certain part of the cornea, which is technically called *nebula*; it is at other times more considerable in quantity, and produces an appearance of considerable opacity in the cornea, which is usually called *albugo*, or *leucoma*. The deposit of matter is sometimes confined to a simple speck, and is sometimes spread more or less over the whole surface of the cornea, so as to interrupt or intercept vision altogether.

The inflammation sometimes proceeds to the suppurative process; indeed, the tunica conjunctiva appears to be of a nature very analogous to the mucous membranes of the body, and like these, is exceedingly prone to the suppurative stage of inflammation. The suppuration gene-

the conjunctiva ...

vicinity, and a little abscess or pustule
centre. Ulceration is also sometimes
usually occurs in the cornea, in conseq
open this pustule, probably from the de
posure of the cornea. Lastly, sloughing
tion of the cornea is not an uncommon
degree of suppurative inflammation. T
quences, therefore, occasionally arise fro
of the conjunctiva as from inflammation i
the body; namely, effusion, adhesion, su
ation, and mortification.

Of the treatment of simple inflamma conjunctiva.

It will be necessary to adopt at once,
antiphlogistic plan of treatment. As t
diminishing the action of the heart and
of the lancet should be freely resorted
mencement of inflammation of the con

fected, and carry on the bleeding even to faintness. This may prevent the necessity of again having recourse to the lancet; or if it should be necessary to do so, blood may be taken away in much smaller quantities. The patient's pulse is the only certain criterion; and when this is diminished, leeches may be afterwards conveniently applied.

The application of leeches, in the first instance, except in large numbers, is seldom sufficient in acute inflammation; three or four leeches will scarcely produce any effect upon it. Opening the temporal artery is another mode of bleeding, which is attended with very good effects in this inflammation. This practice has been decried by some persons, who suppose that by opening the temporal artery you force the blood to pass through the anastomosing branches, and in this way throw more blood into those vessels which are immediately distributed to the eye. Whether this be the case is not quite clear, but certainly good effects have been observed from opening the temporal artery in this inflammation, and therefore it may sometimes be proper to adopt this practice. Some practitioners recommend the practice of dividing the vessels of the part by scarifying the conjunctiva. This is a practice, however, which is not to be recommended; the quantity of blood taken in this way is small; the irritation produced in performing the operation is considerable, and the clots of blood left after it often excite or keep up inflammation of the conjunctiva.

Great benefit is derived from treatment directed more especially to the body at large; such, for instance, as diaphoretic medicines. The tartrate of antimony is a very

should be given in such
tervals, as to keep up a state of nausea
dicines are thought by some persons to
cessary in this inflammation. Richte
writer on surgery, is of this opinion
extraordinary, for much benefit will
from evacuating the bowels of any acc
lent matter. Constitutional irritatior
abated by keeping up the secretions f
and in many cases, by altering and r
healthy. The bowels should ther
upon by doses of calomel, combine
mony, or cathartic extract; and the
dicines should be kept up by the
salts, so as to produce a considera
stools. At the same time, the diet
be low, and he should be kept in
and quietude.

When an impression has been r
it will then be proper

be kept well ventilated, for this is a very material nt, but only that the patient should not be exposed to iations of temperature. With respect to local appli-ions, it will in general be found that moist warmth is st agreeable to the patient in acute inflammation of conjunctiva. This may be applied in the way of fo-ntations, either by means of tepid water, or decoctions marsh-mallows, poppy-heads, or camomile flowers. here there is much irritability, steam will often be nd useful, and especially the steam of water in which um has been infused, from which the patient will ex-ience great relief.

Some persons recommend a sort of poultice, although m the tumefaction of the lids, this is an application ich cannot be very conveniently used. The poultice, course, is not of the ordinary description; it is gene-ly made of camomile flowers, boiled so as to be rendered remely soft, and put into a gauze or muslin bag, which uld be applied so as to make a very slight degree of ssure on the eye. If poultices are employed, they uld be very frequently changed, for otherwise they very apt to confine the secretions, and rather to keep than diminish irritation. Fomentations, however, are atly preferable.

Many persons prefer cold to warm applications; if d applications are employed, care must be taken that y do not stimulate the part. The choice of cold or rm applications should depend entirely on the feelings the patient; if he do not find relief from warm, you uld then try the effect of cold applications. In gene-, moist warmth has, however, a tendency to produce

mischief instead of good. On ... sary to observe attentively the chan tion from the acute to the chronic of treatment may be altered as soon has commenced.

In the *chronic stage* the evacuati considerable extent, be laid aside; t not stimulating, may be more gen no necessity for continuing diaphore skin will generally be sufficiently r necessary to evacuate the bowels so f tion should be paid to their due s dicines will often be found benefici cations should be of an entirely diff ought to be moderately astringent your object now is to excite some de vessels, and to get rid of their relax being taken at the same time not t too much.

Various collyria or eye-waters a

copper, may be dissolved in an ounce of water. The solution should be gradually strengthened, in proportion to its action on the part and the degree of stimulus which may be required. To judge how far the stimulus may be carried, the criterion is exceedingly simple; if a certain degree of smarting and pain is produced, which soon subsides, and leaves the patient much more easy than before, the collyrium is beneficial; if, on the other hand, the patient experiences a great degree of pain, which does not subside speedily, and the vessels become turgid, the collyrium is doing harm, and the quantity of stimulus ought to be diminished.

The best mode of applying an eye-wash of this kind is to inject it by means of a silver or ivory syringe, introduced under the lids every two or three hours. In this way, the solution is more surely diffused over the whole surface of the conjunctiva. An eye-cup will answer the purpose very well, if the patient, after immersing his eye in the cup, has the courage to open it. The syringe, however, is a more manageable instrument. Mr. Ware recommended, in chronic ophthalmia, what in the old pharmacopœias used to be called tinctura thebaica. The vinum opii will answer the same purpose, and seems to be one of the best stimula which can be employed in chronic ophthalmia; it acts as a mild astringent, and at the same time, by its soothing quality, sheathes the effect of the stimulus, so that no pain is produced. Patients are able to bear them stronger when the chill is taken off from them; the warmth of the application seems to take away the pain, while the effect remains the same. The *vinum opii* may be employed in the quantity

fluid may be diffused over the whole s
has seen this application used two or
and in the case of children, sometim
with the most decided benefit. Ther
stance which should be attended to i
chronic ophthalmia, namely, not to
much as in acute ophthalmia. If th
moderate degree of light, it should
He should wear no bandages, and ha
tion than a shade. Continued da
very apt to keep up a morbid sta
irritability in the eyes. Lastly, t
treatment of chronic ophthalmia,
which predispose to, in some inst
many keep up, this state of the con
therefore, with those remedies wh
pointed out, others must be given t
state of the constitution which keeps
tion, and success in the treatment
will very materially depend on the

very destructive in its ultimate effects. This form of the complaint requires very active treatment. The symptoms are so manifest that there can be no doubt of the nature of the complaint, its prominent character being the formation of a considerable quantity of purulent matter. In other respects, the symptoms are not very different from those which characterize inflammation generally. The patient at first feels an uneasy sensation about the eyes; next some degree of pain on the admission of light, which increases to a considerable intolerance of light. Redness of the vessels is observed, and besides this, a greater degree of swelling than commonly attends simple inflammation. The eyelids soon become much swollen, the conjunctiva, where it covers the fore part of the globe of the eye, is tumid; there is considerable chemosis, and often such turgescence of the upper lid as to prevent the patient from raising it. The lids are often so much tumefied as to become everted, so that a sort of roll of the lid is formed. These are the symptoms which precede the discharge of matter.

A fluid first appears which is not opaque, and has the character of tenacious mucus; in the course of twenty-four hours it assumes the appearance of pus. It is thick, yellow, sometimes green, and poured out in considerable quantity. The appearance of the tunica conjunctiva has been not inaptly compared to the fœtal stomach, when injected. It has the appearance of a villous membrane highly injected with red blood, and certainly very nearly resembles the internal surface of the fœtal stomach when highly injected. If examined with a glass, drops of pus

the atonic stage, in which there is a
and congestion of the vessels of the
the violence of the acute sympton
the patient labours under conside
strength.

Purulent ophthalmia has a great
minate in sloughing. The cause
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vers thinks that it is produced by
small vessels distributed to the part
same way as sloughing of the glan
phymosis by the cutting off of su
the sloughing commences in a s
dually lamella after lamella is dest
ture assumes a funnel-like shape;
forms in a considerable portion
and opens into the anterior cha
ment of the sloughing process
haziness of the cornea, which
When a dark

the common effect is that the aqueous humour will escape; the iris will become prolapsed into the aperture of the cornea, but the patient may afterwards recover, and though the shape of the pupil will be altered, he may still retain a considerable degree of vision. When the opening is large, the iris will not only be prolapsed, but protruded; not only the aqueous, but the crystalline, and the vitreous humours will escape, and the sight of the patient will be irretrievably lost.

The causes of purulent ophthalmia are various; it is often occasioned by the violent degree of inflammation produced by some highly irritating substance, such as caustic lime. It occurs occasionally in new-born children; in this case it is doubtful whether it arises from the first exposure of the eye to the light, or, as is commonly supposed, from the application of the vaginal secretions to the eyes of the child on its passage into the world. It generally takes place in the first week or month after the birth of the child, and seldom later than three months.

Gonorrhœal ophthalmia.

One of the most violent forms of purulent ophthalmia, is that which is called gonorrhœal, from its being produced by the application of gonorrhœal matter to the conjunctiva. This of all others produces the most intense degree of inflammation. It may be readily traced to the cause just stated, in consequence of the person labouring under this disease inadvertently using a towel, or any thing to which the gonorrhœal matter has been applied, and thus conveying it to the part. This inflammation has been stated, upon what may be considered

duced in that way, and he does no
sufficient evidence to establish such

Epidemic ophthal

There is another form of ophthal
called the epidemic, or Egyptian;
quence of its attacking a number of
time in particular districts; and Eg
sembles that form of ophthalmia w
were attacked in Egypt in the year
was, however, well known in this
long before our soldiers went to Egy
place in districts where there could
communication with those soldiers
doubt that it arises spontaneously, a
demically a number of persons in the
it arises it is difficult to say; it was
duced in Egypt by the combined effe
but it is doubtful whether it may n

twenty-four hours, we shall be unable afterwards to check the progress of the disease. It will be necessary, therefore, to push blood-letting to a very considerable extent, in an early stage of this inflammation. Topical bleeding, by the application of leeches, is quite out of the question in this complaint, except in the case of children. Blood should be taken in large quantities from the arm of the patient. The army surgeons, who have had the most extensive opportunities of witnessing this form of the disease, all concur in the utility of copious bleeding.

All the antiphlogistic remedies which have been before enumerated, are to be put in practice in this case. Purgatives should be administered so as to produce a considerable quantity of watery stools; diaphoretic medicines, and especially the tartrate of antimony, in doses of a quarter or half a grain, should be given at such intervals as to keep the patient in a state of nausea, and topical applications should be employed very much in the same manner as in simple inflammation. During the first stage of the complaint, moist warmth in the form of fomentations and poultices will be found beneficial. The acute stage, however, is of very short duration, and they are not to be continued beyond that period.

The extent to which the antiphlogistic plan should be pushed must vary, according to the violence of the complaint and the constitution of the patient. Young, robust, and plethoric patients will bear depletion to almost any extent; on the other hand, more caution must be exercised where the patient is of a weakly, debilitated, or irritable habit of body. Nothing must, however, deter from the *adoption of* an active plan of treatment, until

considerably abated; the chemosis
all the acute symptoms more o
this is the case, if attended to in
sequent treatment will in general

It often happens however, th
called to this complaint until it ha
stage, when the conjunctiva is
the pulse depressed, the skin cold
tenance sallow, and when the con
suffered from the progress of the
an entirely different plan of treat
Gently stimulating applications
means of a syringe, so as to cleans
free it from the pus which has c
and at the same time stimulate t
general it will be necessary to
such as bark, for instance, always
action of the bowels, without whic
less, and even injurious to the pati
may be given in the form of extra

must be changed for a gently stimulating and tonic plan of treatment. Weak astringent collyria should be used to favour the throwing off of the sloughs. The solution of alum, of the nitrate of silver, and the undiluted liquor plumbi acetatis are the best. Observe the process of the sloughing from time to time: if there is a firm layer beneath, the patient is going on well, but if the sloughing has a flocculent, soft, ash-coloured appearance, in addition to mild stimulants to the part, tonic remedies, such as bark, ought to be employed.

In the treatment of purulent ophthalmia, it is of great consequence to pay strict attention to the changes which take place in the symptoms, so that neither the depleting nor the tonic plan may be blindly continued. The treatment should be regulated by the violence of the symptoms, and by the changes which take place as the disease passes from the acute to the chronic form. The errors in the treatment of this complaint may be comprised in two words; they consist either in continuing the depleting plan too long, or in not resorting to it sufficiently early. If the antiphlogistic plan be not adopted at a very early stage of the disease, the tonic treatment will afterwards be of no service; and, on the other hand, if the depleting plan be continued too long, the restorative process, and those beneficial effects, which nature would otherwise assist in producing, will be checked.

SECTION 3. STRUMOUS OPHTHALMIA.

Strumous, or scrofulous ophthalmia, is so called, because it is met with in those persons who are of a scrofulous diathesis—*it occurs in* children, and not unfrequently in

there is one symptom invariably
light. The patient cannot bear t
there is great difficulty of opening
palpebrarum appears spasmodica
difficult is it for a patient to ope
seldom do it: an adult may hav
but it is necessary that the eyes s
only way in which this can be don
of the patient, when it is a child
with the forefinger of the one han
and that of the other to depress th
you an opportunity of seeing the
great caution will be required to
under lid, or any undue violence t
conjunctiva is examined, it is surp
it is inflamed, though the child
from the mother's lap. It will b
the eye frequently during this stat

Disorganization of the differe

tense redness of the conjunctiva. Under these circumstances, similar ulcers form in different parts of the cornea. The formation of these ulcers produces all the symptoms of acute inflammation of the eye, and the organ not unfrequently becomes slowly and gradually disorganized. So long, however, as the cornea continues bright, and of its natural colour, there will be no danger to be apprehended from the formation of ulcers. But it is of the greatest importance that the cornea should be narrowly watched, as, if the inflammation continues for a long time, ulcers are very apt to form on it. But the most distressing symptom, and the one about which the patient expresses the greatest uneasiness, is the intolerance of light.

Treatment of strumous ophthalmia.

Although this inflammation is one of the atonic kind, yet there exists considerable irritation. Depletion must be had recourse to, but not to any considerable extent; it will be right to apply leeches, but certainly blood-letting should not be pushed too far, and throughout the whole treatment it will be necessary to keep in view the nature of the constitution which is generally met with in scrofulous subjects; it is languid and debilitated; the digestive organs are deranged; there is loss of appetite—tongue white and furred; bowels torpid; secretions defective in quantity and in quality—skin dry and hot; in fact there is a good deal of fever present.

The mild depleting plan must be first adopted, regulated as far as the constitution will bear it: remove the symptoms of irritation; open the bowels freely by calomel purges, repeated more or less frequently as they improve

When the fever becomes dimi
form their natural functions, the
the skin assumes its healthy feel,
remedies. Aromatic bitters, com
be found useful remedies. But,
state of the constitution must be
to regimen and diet. The food
tritious, clothing warm. Exerc
taken; not to such an extent as t
ments, but to invigorate the healt

Sea-bathing will be of advanta
stitution is not in that state to
warm should be used; and if the
where sea-bathing cannot be resor
himself with tepid water, gradual
to the use of cold; by this means
be much improved.

As for the treatment of the
right to employ depletion at the on

of water containing opium allowed to go on the eyes will be good. About a drachm of opium dissolved in a pint of hot water, and the steam of it directed over the eye, will relieve, to a considerable degree, the irritation.

But if any of these applications be used at the onset, they must not be long continued before recourse is had to mild astringent collyria. Their strength must be regulated by the feelings of the patient; not so strong as to irritate, but to be followed by relief to the part affected. The vinum opii is a remedy particularly adapted to this complaint, at an advanced stage: it tends considerably to lessen the irritability of the part, and to increase the strength of the relaxed vessels. At the onset, however, a more active plan of treatment must be adopted: relief must be sought by the application of leeches and blisters, more especially by the last. It will be necessary sometimes to give mercury so as slightly to affect the mouth, remembering the state of the constitution in scrofulous persons, and taking great care that it is not pushed so far as to affect the general health.

The consequences of inflammation of the eye requiring distinct notice, and which are accompanied with equal or less inflammation of the conjunctiva, and kept up or excited by attendant circumstances, are now to be spoken of. In the first place, we shall treat of

SECTION 4. NEBULA.

This complaint is so called from the nebulous or cloudy appearance of the transparent part of the eye, which is produced by deposits of lymph into the conjunctiva covering the *cornea*. The membrane or layer stretched

must be removed by active means; and
will be proper to deplete. The inflamn
is generally of the chronic kind, and aris
state of the vessels, which require stin
tions, in order that they may recover the
vey the blood uninterruptedly. If the ves
the blood will be likely to flow throug
absorbents will be excited, and remove t
By stimulating applications, the cornea
restored to the same state of transpare
attack. Care must be taken that in
undue degree of stimulus be employed
be inflammation it will be increased, a
be as bad or worse than ever. A colly
used, is one with the sulphate of zinc,
grain to an ounce of water, gradual
strength. One which has been rec
with the corrosive sublimate, with a g
water. Calomel or levigated sugar ha

harm, using it alike in a cicatrix from ulceration as in nebula arising from a deposit of lymph. In the one, if it be employed, loss of substance will be the result—inflammation will be excited, and fresh ulcers will form. In the other, that is, in nebula, it will often be of service, care being taken not to produce an over degree of stimulus in the part.

SECTION 5. PUSTULES.

Pustules are generally seated at the junction of the transparent with the opaque cornea; but they may sometimes occur in the cornea itself, or the conjunctiva covering it, or the ball. They are seated in different parts. The appearances that they present at first are red or yellowish spots arising from a deposit of lymph in those parts, and are slightly elevated. There is considerable turgescence of the vessels around them. If they occur on the cornea, it will be nebulous and opaque; the vessels round the cornea will be seen distended, carrying red blood, and having a radiated disposition. If the lymph be not removed by absorption, the pustules break, matter escapes, and ulcers form in their place. Sometimes there is only one of these ulcers, frequently two, one at each side of the cornea, just at the junction of the transparent with the opaque cornea, and occasionally the cornea is even encircled by them. Although the inflammation accompanying the formation of pustules is not acute, yet it frequently happens that there will be more or less pain on moving the eye, intolerance of light, and effusion of tears.

These ulcers are difficult to manage, as they often oc-

are soon reproduced, and the disea
vated. As for the treatment this
will be hardly necessary to say, tha
flammation exists, depletion must
inflammation, however, is of the aton
leeches, but not in large numbers, sc
pletion to too great an extent; it wi
cuate the bowels, not by drastic purge
and to attend to the secretions. B
if the sight be affected. When the
has been regulated, begin with ton
early as possible with mild astringe
best is the vinum opii. The only po
is, that depletion be not pursued to t
the outset. The system must be
remedies, and tone given to the vess

SECTION 6. FUNGUS OF THE

This appearance of the conjuncti
subjects. The conjunctiva become

tiva should be removed, which is a very easy operation. An assistant holding the lid, you, by the means of a pair of forceps, raise the fold of the conjunctiva, and with a pair of curved scissors remove it. As to the after-treatment, you must keep down inflammation, should it appear, by the means already recommended.

SECTION 7. GRANULATIONS OF THE CONJUNCTIVA.

These are nothing more than loose irregularities of this membrane where it lines the lids. These projections continue to pour out a portion of morbid secretion, which stimulates and irritates the whole eye; the palpebral conjunctiva becomes altered in its texture, and its surface is covered with fleshy elevations, having the exact appearance of granulations. These granulations covering the surface of the conjunctiva lining the lids are constantly rubbed over the globe of the eye whenever it moves, producing pain and irritation, and keeping up morbid secretion, and, in fact, giving rise to chronic ophthalmia. Thus easy access is afforded to extraneous bodies, nebulous opacities form on the cornea, vessels will be seen shooting over it, and these will be quite in a varicose state, enlarged, and having a knotty appearance. The granulations, if not removed or remedied, produce ultimate blindness.

Considerable advantage is said to be derived from removing the granulating surface of the conjunctiva by the lancet, or by a pair of curved scissors. Touching the granulations with nitrate of silver or sulphate of copper will *tend materially* to keep them down. The liquor

this statement. If the vessels c
ous, it will be proper to divide
them. This is a very simple c
and press on the globe, by which
projected forwards; then carry
ment round the outside of the
vessels, so that they shall not re
is thrown out, which turns tl
course, excepting perhaps, the
reunite. It will be necessary
Cases of this complaint are diffic
then, the remedies to be used
tions, applying caustic applicatic
the varicose and enlarged vessel
by setons, issues, blisters, and
health.

SECTION 8. PT

This is all of the triangular sh
into the membranous [illegible]

The conjunctiva and sclerotic coat become loaded with vessels, and if this affection is not remedied, vision becomes impaired, and is ultimately lost. The fleshy pterygia differ from the membranous, and are more vascular. They first appear of a yellowish colour. Then the vessels running through them become large, and they have a red appearance; but always retain their triangular shape. When the disease has proceeded far on the transparent part of the eye, the only plan to adopt will be the removal of a part of the pterygium. This consists simply in raising the membrane as near as possible to the cornea, and cutting it through while suspended. When the pterygia are fleshy, more care must be taken in dividing them; they must be divided near to the margin of the cornea, and turned back from the apex towards the base.

CHAPTER IV.

INFLAMMATION OF THE PROPER TUNICS.

SECTION 1. INFLAMMATION OF THE CORNEA.

At the outset, in inflammation attacking the transparent cornea, there is a hazy appearance, the cornea loses its natural lustre, and in a short time there may be discovered on its surface, vessels carrying red blood, and then the symptoms will be the same as those of inflammation in general; the patient will complain of intolerance of light, and also have effusion of tears. When the in-

in the transparent part of the ey
till it occupies one third or fourt
eye be placed in profile, yellowi
be observed, which are usually
part of the cornea, and if gentl
be employed, the fluid may be
In the various positions of the h
shift its situation, but remains
proper treatment the matter ofte
it not unfrequently makes its wa
ing is formed internally, and th
into the anterior chamber of the

SECTION 2. ULCERATION

This disease is the common cc
tion of the cornea; but it is ver
the contact of matter in purule
irritation of lime, or by any sh
may be insinuated into the corn

irritating matter. In general there will be no difficulty in distinguishing ulcers of the cornea; put the eye in profile, take a side view of this organ, and the ulcer will be seen with the appearances already described. The situation of ulcers of the cornea varies; very frequently they are at the superior portion, and affecting only the external lamellæ, in other cases spreading over the whole cornea, and penetrating into the anterior chamber, by which means the aqueous humour escapes, and the iris is often protruded: sometimes even the opening becomes enlarged, and the crystalline lens and vitreous humour escape. The ulcers vary in their appearance, some being large and others small, and those which are of small size, on cicatrization, do not materially obstruct vision, whilst those that are large, when healed, produce a nebulous appearance which destroys the power of sight.

Treatment of inflammation and ulceration of the cornea.

The treatment required in inflammation of the cornea does not differ materially from that of inflammation of the conjunctiva, or any other part of the eye, and therefore it will not be necessary to recapitulate the means necessary to be adopted: rely on the efficacy of a strict antiphlogistic plan, and when the acute inflammation has been subdued, on the use of mild astringent collyria. When ulcers, however, form in any part of the cornea, it will be proper to use active means, if they be accompanied by acute inflammation; but most frequently they are accompanied by chronic ophthalmia, and have a disposition to spread rather than heal. In these cases an-

a state of solution, about two gr
or it will be better to begin wi
regulating the strength in pro
irritation it may produce. Sca
to the caustic itself in the treatm
cornea; the caustic is to be cut
ulcer to be touched with it. An
the course of two or three days,
toms of the disease return as be
to be applied, and to be repeated
sary. The ulcer, by this mean
appearance, the edges become r
rapidly heals. When ulcers of
by acute inflammation, it will
bleeding, by leeches, before the
at the same time to keep the
aperients. During the progress
necessary to watch them very clo
frequently; but in doing it great
lest the eyelids become everted.

SECTION 3. STAPHYLOMA.

In this disease the cornea becomes opaque, considerably elevated, and altered in texture. The eyelids are prevented from being closed; there is perpetual irritation kept up by the friction of the palpebræ on the ball. This disease frequently comes on after small-pox, and is one of the sequelæ belonging to that formidable complaint. By the separation of the lids, extraneous bodies often enter the eye; irritation is produced by the friction of the lids and eyelashes—and thus a considerable degree of inconvenience is produced to the patient, and the eye kept in a state of chronic ophthalmy; and the sound eye becomes sympathetically affected.

In this disease the iris often protrudes; the vitreous humour is altered in texture; and the crystalline lens is projected forwards. In this complaint nothing can be done for the restoration of sight; and the only plan of treatment will be to remove the staphylomatous part, so as to return the eye within the orbit, and permit the use of an artificial eye. The operation is exceedingly simple; the surgeon first passes a needle with a ligature through the staphylomatous part, in order to steady the eye, and then with the other hand takes the cornea knife, and removes as much of the projecting part as may be necessary. The operation gives little pain; it generally happens that the iris adheres to the cornea, and that portion of it is removed. The crystalline lens escapes, together with a portion of vitreous humour, and the eye collapses, so that when the part is healed, an artificial eye may be worn. These are *now made* so much to resemble the natural eye,

cornea loses its natural lustre
paired. Glasses afford no reli
altered shape of the cornea; i
known that does. Mr. Green
this kind, and has not known a
treatment that has been adopted

SECTION 4. INFLAMMAT

Inflammation of the iris, or
called, *iritis*, is a peculiar and sp
eye. The symptoms attending
cases with great difficulty reco
the eye, the iris is observed to b
having a brownish hue; or rath
lour, (this, however, varies acco
lour of the iris,) from the increa
its surface carrying red blood.
in texture, being puckered and
pearances are soon removed,

ing the upper part of the cornea, which have a different appearance from those in inflammation of the conjunctiva, the latter having a tortuous course, whilst the others go in a straight direction. The conjunctiva partakes of the inflammation, and assumes a red appearance. The pain in the eye is not acute, but the patient cannot bear the light. There is also considerable constitutional irritation or fever, which may be known by the state of the pulse, and other symptoms. Inflammation of the iris often comes on from very slight causes; it occasionally happens to those who have been under the influence of mercury, and in persons of a scrofulous diathesis, or when mercury has been pushed to an undue extent.

Iritis has, in consequence of its occurring so frequently after syphilis, been classed as a secondary symptom of that complaint: Mr. Green entertains considerable doubt on the subject, for he says he has never met with it in a person labouring at the same time under any other secondary symptoms of syphilis, with eruptions or nodes on the bones: and also has never met with a case of iritis after syphilis, but when mercury had been previously given, and therefore he is doubtful whether the inflammation of the iris was the effect of the mercury, or of the original disease for which it was given.

Ophthalmitis.—Iritis is not unfrequently accompanied by inflammation of the tunics of the eye—what may be called *ophthalmitis*, or deep-seated inflammation of the globe of the eye. In this complaint the sclerotic appears reddened—the cornea is dull, and the capsule of the lens itself becomes opaque: all these participate in the inflam-

in a straight course, while those of the c
tortuous. There is pain in the eye, intole
also these symptoms, together with a turb
humours, are sufficient to inform one of t
inflammation of the sclerotic coat: the p
bours, at the same time, under great febr
This inflammation is often attended by a
of the organ.

Hypopium.—The result of this severe i
mation, if it be not checked, is effusion of l
into the anterior chamber of the eye, pro
technically called *hypopium*. In these ca
may be easily observed, and sometimes the
to conceal the edges of the pupil and the ir

Treatment.—Of course the first part of
will be to relieve the irritation of the part l
both general and local; and, in fact, all t
pletion must be adopted, as in other inflar
eye. But there is one remedy above all

ing in the dose of two or three grains, combined with about a third or a quarter of a grain of opium, so as to prevent its acting on the bowels.

In order that the calomel may affect the system, it must be given every fourth or sixth hour, till the mouth is sore; in more chronic forms of this complaint, it may be given less frequently. As soon as the system has become affected, the zone of vessels will gradually disappear, the lymph become absorbed, the aqueous humour become clear, and the cornea lose its hazy appearance. Other remedies have been recommended, but the exhibition of mercury alone can be relied on. The belladonna will be found a very useful adjunct in this complaint; by dilating the pupils, the adhesions are often prevented from forming between the iris and capsule of the crystalline lens, and when they are formed it tends to elongate the adhesions. The belladonna should be applied, in the form of extract, around the eye, morning and evening.

SECTION 5. AMAUROSIS.

By amaurosis, is meant partial or total loss of vision, arising from paralysis of the optic nerve or retina; and this is produced by a congestion of the vessels of the part, or minute alteration of its structure. The symptoms distinguishing this complaint are few, and therefore require to be well known. The pupil is generally dilated and motionless; the iris is nearly immoveable, acts very little, and vision is completely destroyed. There is also slight strabismus. In amaurosis, there is frequently the sensation as if a cloud were before the eye, which is termed

plaint are those who have been in the l
minute objects, or exposing the eyes
Persons affected with amaurosis are fre
with false appearances—as flashes of ligh
before their eyes. The causes of amaur
vided into three parts:—1st, Those whic
or optic nerve. 2d, Those affecting the l
of it from which the optic nerves arise, t
rum opticorum. And, 3dly, Those affe
large, or some particular organ, and thu
affecting the eye.

As causes of the first and second, we n

1. Lesion, extravasation of blood, in
sition upon either of its surfaces, and lo
of the retina.

2. Morbid growths within the eyeball
and all such disorganizations as directly
the texture of the retina.

3. The state of apoplexy, hydrocepha

liver, kidneys, uterus, mammæ, and testes; various forms of injury and disease; and sudden translations of remote morbid actions.

2. Idiopathic paralysis, suspension or exhaustion of sensorial power from various constitutional and local causes; from undue excitement or exertion of the visual faculty; and from the deleterious action of poisons on the nervous system, as lead, mercury, &c.

The third division, or *functional amaurosis*, admits of the following subdivisions:—

1st. *The symptomatic*, or that which is only a symptom of some general disease or disorder of the system, as for example, general plethora, general debility, &c.

2d. *The metastatic*, or that produced by the sudden transference of the morbid action from another organ of the body; as for example, from the skin, the testicle, &c.

3d. *The proper*, or that which immediately depends upon a peculiar condition of the retina; as for example, the visus nebulosus, muscæ volitantes, &c.

Diagnosis.—Amaurosis depending on a change of structure in the brain or eyeball, is an irremediable case. The same may too often be said of that which presents no evidence of structural disease. For there are certain cases purely functional, so nearly approaching in character to the organic class, as at once to convey the impression of their irremediable character. On the other hand, cases are of frequent occurrence which admit of material and decided improvement, and even of complete recovery.

Treatment. The treatment of amaurosis is almost exclusively constitutional, and must be of the antiphlogistic kind. *The cure*, in fact, of amaurosis, like that of in-

abstraction of ...
antiphlogistic remedies, and afterward
so as to affect the system: indeed, m
fectually to check the progress of i
retina as it does that of the iris, and
in checking the progress of the chro
the retina, which is the ordinary ca
in checking the progress of the more a
would constitute *retinitis*. In order t
vantage which this remedy is capabl
necessary in these cases to produce it
the system, and sometimes to keep it
Such at least is the opinion of Mr.
that "it is not sufficient just to ren
mercury sensible on the mouth, and
it; pretty active salivation must be
order to enable you to derive all th
medy is capable of affording." M
trary, thinks, that "no advanta
vation;" he considers it positive

of the neck. Other plans of treatment have been recommended; cupping, issues, and setons, have been severally employed with advantage. The employment of electricity also has been recommended, but has hitherto been attended with little or no benefit.

The *constitutional treatment* necessary in amaurosis is various according to the circumstances. Extremes, it is said, meet, and it is certain that a strong and delusive similarity often prevails between the signs of diseases, which result from conditions diametrically opposite. In cases of general plethora and of cerebral compression, the treatment is obvious enough. Under an idea that the deficient state of vision arises from weakness of the nerve, all kinds of tonics, stimulants, antispasmodics, have been tried without any good result. Neither has the emetic practice recommended by Scarpa, been successful in this country. In most of these cases, we must depend, first, on the regulations of the visceral functions; and secondly, on the employment of such restoratives as the system requires and can bear. The blue pill, with colocynth, rhubarb, or aloes, and the combination of soda with rhubarb and calumba or gentian, are best adapted to the former purpose. The exhibition of general tonics is often strongly indicated, and much benefit has been derived from the mineral acids, bark, steel, when admissible, and arsenic after a due regulation of the digestive functions.

Superadded to the entire repose of the organ, the natural tonics, viz., a pure dry atmosphere, the cold bath, horse exercise, nutritious diet, early and sufficient rest, agreeable society, and a mind as much as possible diverted from the object *upon* which it is unfortunately and pertina-

CHAPTER V.

AFFECTIONS OF THE HUMOURS OF T

HAVING described the affections of the coats it is necessary in the next place, to treat of t humours of the eye. Very little, however, ca the aqueous and vitreous humours, as most of to which the humours are subject, attack the lens, or its capsule.

SECTION 1. HYDROPHTHALMI

The aqueous humour is sometimes the s accumulation which is known by the name of *mia* or dropsy of the eye; and consists of secretion of this humour. The symptoms of t are—that the eye becomes more distended widened; the sclerotic coat at

been tried generally without any good effect. Puncturing the cornea, at a short distance from the sclerotic, has been tried, and it is said with success. Mr. Green has seen several cases of this affection, in which no benefit whatever was derived from any means that were employed.

The *vitreous humour* is occasionally affected. There is sometimes a deficiency of this humour, arising from part of it being lost in the course of an operation: and the quantity lost is often so considerable, that the part supported by the aqueous humour is not sufficiently firm to keep up the natural roundness and plumpness of the eye. The medium of refracting the rays of light is destroyed, the sight becomes impaired, and glasses afford no relief.

There is the tremulous iris after couching, arising from the same cause as the preceding affection. Another change which takes place in the vitreous humour is that known by the name of *glaucoma*.

SECTION 2. GLAUCOMA.

In this complaint the vitreous humour becomes altered in texture, more dense, and presents a sea-green hue, and the pupil is dilated. This disease has often been mistaken for cataract, and a person affected with it is frequently supposed to have a cataract in its incipient stage. On examining the eye minutely, this greenish appearance may be observed to be behind the crystalline lens, and posterior to the seat of the cataract; it may be, however, mistaken for many diseases, and has a greater resemblance to cataract than any other. Glaucoma remains without any *change by which* it may be distinguished from fungus

of the eye, which will be described presently. The nosis is not difficult.

SECTION 3. CATARACT.

By cataract, is meant a partial or general opacity crystalline lens, or of its capsule, or of the liquor gagni which intervenes between them, or of all taken together. Cataract from opacity of the hu Morgagni, is very rare, and in the belief of some, hypothetical. This complaint seems to have been u stood by Hippocrates; but the notions of Galen those who followed him, respecting cataract, were confused; and it was not till the end of the 17th, ginning of the 18th century, that the nature of this began to be understood, when Merry and Maitre-Jea others, gave fair accounts of this complaint.

The symptoms of cataract are unequivocal, and easily recognized. At first there is always defect of and the patient sees things as through a mist, a quires a strong light to see them plainly; this sy changes during the progress of the complaint, t tient being able to see better in a moderate strong light; and then a speck or opacity in t or capsule may be distinctly observed; it is ge in the centre of the pupil, and the situation lens; this gradually enlarges, and, in proportion opacity increases, the sight becomes more dim, a capability of discerning objects diminishes. In t gress of the cataract, the patient can see bett *faint than in* a strong light; and this is easily ex *because in the* faint light the iris dilates, and

of light are transmitted through the circumference of the crystalline lens, which is not yet obscured.

But as these symptoms differ in the different varieties of this disease, this leads to the consideration of the different species of cataract: it is extremely important that they should be known, as the operation necessary to be performed, depends on the kind of cataract which exists; but it is to be observed that the criteria are, to say the best of them, very fallible. On looking at a cataract, a surgeon cannot always be certain that it is of this or that kind, but on the whole is enabled to give a pretty good guess. The symptoms characterizing each kind will be described under their different heads.

Different kinds of cataract.

There are four kinds of cataract: 1st, the hard or firm cataract; 2d, the fluid or milky cataract; 3d, the soft or caseous cataract; and, besides these, there is a fourth kind, the capsular cataract; the three first forming in the lens itself, and the last in the capsule.

The last kind of cataract comes on after an operation or in consequence of it, and is also found in children, when it is called congenital cataract. This kind of cataract does not differ essentially from the other forms of capsular cataract, but is called congenital, on account of its occurring at a particular period of life, or children being born with it. This form of cataract also requires a particular kind of operation, and will be particularly spoken of.

Of the lenticular cataract there are three kinds, the *soft, fluid, and* hard. These different kinds of cataract

necessary to mention, [illegible]
one form to go into another—for the soft to g
hard, for instance, is exceedingly rare. This
the more necessary, in consequence of an opi
used to prevail, that a soft cataract became
then it was said to be ripe. This idea is now
and experience proves it to be incorrect.

Let us now consider the different symptom
the different kinds of cataract.

a. Firm or hard cataract.

In this kind of cataract the lens acquires a
gree of density or firmness than natural; an
going this change, it becomes smaller and
more concentrated. If you look at the catar
see that it has not the natural whiteness
plaint: it has a yellow or brownish app
colour of amber. The next particular to b
the interspace between the iris and front par
on account of the lens becoming thinner.

symptoms, then, may this kind of cataract be distinguished:—by its colour and size, the interspace between the front part of the lens and the iris: the vision being more or less distinct; and, lastly, by its occurring at an advanced period of life.

b. Fluid cataract.

This kind of cataract is always more or less fluid, and is called milky, from its white colour. The fluid cataract is not of equal density throughout. If the eye of a patient be examined with attention, a flocculent appearance will be observed, from specks or streaks consisting of solid particles of the lens, and these will move up and down in the various positions and motions of the head, and be removed out of sight; but on the head becoming steady, they again appear. This arises from their gravity; on motion, they sink to the bottom, and of course disappear. There will not be any difficulty in recognizing this form of contract. Besides these symptoms, the lens becomes enlarged and globular; and the increase of size is such, that the lens reaches to the iris, so that there is no posterior chamber at all. If the surgeon look at the eye in profile, he will see that the iris is protruded forwards; from this pressure the motions of the iris are sluggish, and in some cases prevented altogether. The size and shape of the pupil is altered. The rays of light do not pass into the eye, and the patient can scarcely tell the difference between light and darkness.

c. Soft or caseous cataract.

This kind of cataract is of the consistence of firm jelly

in size . . . . . .
no interspace between the fore part of the
The motions of the iris are performed with
the size of the lens, and the rays of light
from entering. The patients sometimes
guish between light and darkness; alth
seldom so blind as this.

d. Membranous or capsular cata

This form of cataract is not connected
but the capsule itself. This opacity may
the posterior or anterior layer of the capsu
with that of the lens, and thus produce ca
last case there is no distinct mark of diagn
the capsule only is affected, the surgeon
opinion. If the anterior layer of the ca
it has the appearance of being superficial
pupil, and appears rather nebulous. It do
its transparency, but becomes semi-trans
the posterior layer is affected, this appea

Another species of membranous cataract is, when the capsule becomes opaque, and the lens at the same time absorbed, and a tough, dense, membranous substance is formed, as in congenital cataract.

These are the different diagnostic marks for detecting the different kinds of cataract; and, from the nature of the observations, it will be evident how difficult it is to distinguish them. But it is necessary, as far as is possible, to be acquainted with the appearances each form of cataract presents, as the treatment or operation required must be adapted according to the kind of cataract.

Causes of cataract.

The causes of cataract are in general very obscure. Cataract sometimes arises from obvious causes—injury, violence, inflammation, or sharp-pointed bodies wounding the capsule of the lens, or the lens itself, and consequently producing opacity of these parts. The opacity arising from this cause often becomes absorbed, and the case undergoes the natural process of cure without requiring an operation. It is produced too by inflammation of the globe of the eye; but then the cataract is capsular, and not lenticular.

Cataract, however, arising from these causes, is exceedingly rare; and by far the greater number of cases are produced, as it is called, spontaneously, or under circumstances which are too subtle for our cognizance. It has been said that where the eye has been tried a good deal, and subject to much exercise and strong light, as in blacksmiths, glass-blowers, &c., that cataract is produced; this is *exceedingly doubtful*; and if it is so, there are many

that it may be produced by external causes
vious, yet it more frequently comes on with
able cause.

Prognosis.

Of course, by this is meant a prognosis
of the case by an operation; it is desir
to ascertain whether service can or can
by the operation; whether the changes
may have undergone from inflammati
progress of the complaint, or the symp
as to preclude the chance of success
were performed, and destroy all hopes
being regained. Now there are certain s
panying this affection, by which the surg
form a pretty accurate opinion as to the i
some extremely valuable observations on
subject to be found in Scarpa's work on t
eye.

The first circumstance which leads

which it will be necessary to inquire about; third, whether the motions of the iris are duly performed, in the different variations of the light; if not, fear may be entertained of the eye being amaurotic; fourth, if there is the power of distinguishing between light and dark, or the colour or forms of things, or the shade of passing objects.

These circumstances should be particularly inquired into; and if the patient has all, or the greater part of them—that is, if the defect of sight has been increasing just in proportion to the increase of the opacity of the lens, and the patient has had no pain in the head, and the motions of the iris are free, and light can be distinguished; then the surgeon may operate, and with the chance of success, as there are no evident reasons against it.

For by the first circumstance we learn that the vision has been impaired in consequence of the opacity of the lens; by the second, that there has been no disorganising inflammation in the eye, or that the brain and origin of the optic nerves have been affected; by the third, that the retina is sound; and by the fourth, if the opacity of the lens be removed, that the retina will be in a state to receive the impression of external objects. But these signs are not so certain as they might appear, for the iris might act, and yet amaurosis exist: and if one eye were not closed, the motions of the iris of the other might be prevented, by sympathy from the other. Thus it appears that the state of the iris does not always determine the existence of amaurosis.

When there is cataract the operation must be regulated by *taking all the circumstances* into consideration; by the

able symptom, yet persons may [illegible]
able to distinguish day from night, and even c
one another. On the whole, it is a very
symptom, and when present, the operation r
formed. In general, when the case is do
surgeon had better perform the operation, of
ing care to inform the patient of the state of tl
pain is not great, and you will not leave the
worse state than before the operation. It v
tremely culpable for any one to operate where
apparent that no relief could be afforded; a
viduals have operated where there was no m
doing good, than if the eye had been scoope
head—such men are unprincipled, and wou
any thing for the purpose of gain.

Another question to be determined on is,
operation should be performed if one eye onl
The answer appears to be plain, yet there s
contend that the operation should be reso
there is cataract in one eye only, and their pr

ght. The disadvantages of this plan are various; it ie that a sympathy exists between the eyes, and that flammation is set up in one, it will be excited by athy on the other, which may destroy the organ is sound. But suppose success attends the operation, is the effect? the focus will be different, and the nt will not be able to use both eyes at the same time. xt, where there is only one eye sound, and it per- s its office well, and vision is good, it will be better to till it becomes dim; then the operation for restoring atient to sight may be performed, and two chances the patient's favour. Therefore it seems that in rming the operation for cataract, where one eye only ected, the patient is exposed to the risk of losing the of both. The plan that appears to be the best is, o operate except both are affected; then the opera- may be safely performed.

CHAPTER VI.

RATIONS FOR THE CURE OF CATARACT.

ORE speaking of the operation for cataract, it will be cted perhaps to premise by saying something of the ment; but besides an operation in this complaint, little else in the way of treatment will be of use. ous plans of treatment have been adopted, but with- uccess; therefore, it is better at once to describe the ations. The operations for cataract are three in ber—*first, depression*, or couching, by which the

This mode of operating consists in remo
lens out of the axis of vision, by depressin
treous humour: this is done by a needle,
are three different kinds now employed,
and Beer's needles.

Hey's needle is about seven eighths of an
it is rounded except at the point, where
eighth of an inch; it terminates by a sem
edge, which ought to be exceedingly s
needle is more slender than the other, an
point. When you look at it sidewise, i
convex appearance on the dorsum, it is
shape towards the point, and has also a
sufficiently strong to depress the lens. T
spear-pointed needle; it is narrow at the

Mr. Green gives the preference to tl
ment; a surgeon is not so likely to w

Mode of operating.

next come to the mode of performing the operation.
ght, and the position of the patient and operator,
tremely important, and all to be attended to. The
hould be clear, distinct, and full, but not vivid, and
ıld not fall on the centre of the eye of the patient,
:erally, else it would produce a dazzling, and un-
ıess of the organ. The patient should be placed on
ıeat with a high back, and the head resting against
the body of an assistant. The operator should be
igh stool, or at least of sufficient height to enable
put one foot on it, and rest his elbow on the knee
:e to the eye to be couched. Having thus prepared
f, the operator holds the instrument between the
and fore-finger, the assistant passing his fore-finger
the head of the patient, raises the upper lid by a
skin, and presses it gently against the superciliary

The patient is now directed to look inwards to-
the nose, and the operator, resting his little finger
upper part of the chin of the patient, penetrates the
ic coat about a line and a half from the junction of
ınsparent with the opaque cornea, and a line below
ınsverse diameter of the eye.

:he first place, the needle is introduced here, just
the retina terminates, and the ciliary ligament com-
s, so that these shall be avoided; and, 2dly, for the
e of not wounding the ciliary artery, as it goes
the middle of the external convexity of the eyeball,
ın the sclerotic and choroid coat. In using Bear's
it is introduced with the edge laterally, and its

and then the point carried inwards [illegible]
so as to cover the posterior chamber; the instr
be now visible through the pupil. When this
the operator must raise the needle upwards, a
press it downwards, and backwards, and a littl
by which means the crystalline lens becomes
the vitreous humour. If the lens should ri
situation, it must be again depressed, and
safely lodged in the vitreous humour, the nee
withdrawn.

Some continental surgeons perform the ope
clination, which consists in turning the le
pushing the upper edge backwards, and th
wards, and likewise in puncturing the corn
the sclerotic; the best plan is that reco
Scarpa.

The after-treatment is very simple, and
single fold of linen, moistened in cold water,
to the eye. The patient is also to be put in
[illegible] and narrowly watched, in order to se

it. Considerable improvements were subsequently made in the mode of performing it by Wenzel, who practised it with great dexterity, and astonishing success. There seems to be no necessity for preparing a patient for this operation, beyond taking care that his bowels be duly evacuated, and that he has not used any unusually stimulating diet previous to the operation. It would be highly improper to perform it, if the patient was at the time labouring under any other complaint or morbid affection; means should be taken to remove any complaint of this kind before the operation is attempted. Beyond these precautions, however, no preparatory treatment will be necessary, though I am aware that much stress was formerly laid upon this point. Several instruments will be required for the performance of this operation, which is a more complicated one than couching.

In the first place, a cornea knife will be necessary; the knife used by Wenzel, was something like a bleeding lancet; the blade, however, was neither so long nor so broad, and the edges were straight. Ware's knife was an improvement on Wenzel's; it is much less spear-pointed; the edges are straight as in Wenzel's, but while the lower edge is cutting, the superior edge is only cutting towards the point. From the point towards the handle there was a gradual increase in the size of the knife, a circumstance upon which Ware particularly insisted, in order that the knife, on being carried onwards, might always follow up the opening, so as to prevent the escape of the aqueous humour.

Wenzel's knife, however, and Ware's improvement upon it, are greatly inferior to the knife contrived by

cutting towards the point, and [illegible]
creased from the point towards the handle, s
the opening, and prevent the escape of the
mour. Beer's knife is preferable to either o
because there is a much greater extent of cu
so that the section of the cornea is completed
time and in a safer manner; it is besides cap
made with much greater accuracy.

A speculum was sometimes used in this o
it is not at all necessary; in fact, all spec
tionable, as they are likely to produce undu
the globe of the eye. The next instrume
curved scissors, in order to enlarge the oper
the cornea, if it should not be of sufficient
the cataract. A minute curved needle wil
in order to scratch the capsule of the cr
a curette, or scoop, to remove any opaqu
the lens, and a pair of minute forceps, of
construction is that recommended by Beer
[illegible] of opaque membrane from the cap

the sun should happen to shine, a north window should be chosen; the inner side of the eye towards the nose, where the point of the knife is to be carried through, should be well brightened. The patient should be seated in a low chair with a high back, his head resting against it, or firmly supported against the chest of an assistant. The operator should place himself behind the patient in a chair of sufficient height to enable him to plant his foot conveniently on a stool, and resting his elbow on the knee opposite to the eye to be operated upon, bring his hand towards it. The assistant should then place his hand behind the patient's head, and with the extremity of his fore-finger gently raise up the lid without making pressure on the globe. The operator then takes the knife in his right hand, if it be the left eye which is to be operated upon, and in his left if it be the right eye, in the same way as he would take a pencil between his fore-fingers and thumb, resting his little finger upon the malar bone.

The first thing which the operator then does is, to make what is called the punctuation of the cornea. He introduces the point of the instrument at the distance of half a line from the anterior junction of the cornea with the sclerotic coat, and passes it in a direction nearly parallel to the iris, and before it with a little obliquity, through the anterior chamber to the opposite or nasal side. In making the section of the cornea, the knife should be carried onwards, without any downward motion; and as soon as the section is completed, the lid should be allowed to drop over the fore part of the eye, to prevent the *escape of a portion* of vitreous humour. If there should

fore part of the capsule, moves [illegible]
wards, and laterally from side to side, maki
crucial incision. He then squeezes out the
making gentle pressure on the globe above
until the lens is lifted from its bed, and pa
the opening of the cornea upon the cheek of t

All that then remains to be done is to exam
there are any opaque fragments of the lens l
are, they must be scooped out by the curette
upper lid is to be rubbed over the surface of
If there is any portion of opaque membrane
must be removed by the forceps, and in this
ration will be completed.

Many untoward circumstances, however,
terfere with the success of this operation.
place, the section of the cornea may be too sm
case the surgeon will either be unable to disl
ract, or so much force will be required for
as is likely to produce serious inflammation
degree of disorganization as will destroy

sufficiently large, do not hesitate to use the scissors, er to make it large enough to admit the passage of taract.

) second untoward circumstance which occasionally ires, is the premature escape of the aqueous humour, from the unsteadiness of the operator, or from some in the knife. On the escape of the aqueous humour, s loses its support, and becomes prolapsed. When appens, the way of preventing any mischief will be,) continue the incision, but to rub the cornea with int of your finger, by which the prolapsed iris will be ated to contract; and on this being removed out of ay, the operator may complete the incision. This expedient recommended by Wenzel and Ware, and wers the purpose extremely well.

) third unfortunate circumstance which sometimes is the loss of a portion of the vitreous humour, g from some undue pressure on the globe of the eye) operator or assistant, or from some spasm of the es of the eye, though the last cause seldom happens. ier way in which this accident sometimes occurs, is the needle is injudiciously used too near the circum- e of the lens, and the capsule of the vitreous hu- is torn through; so that when you make pressure) globe, instead of the cataract coming forward, a portion of vitreous humour is protruded. In this he operator should not attempt to force out the cata- but should endeavour to entangle it as much as le, so as to prevent the escape of the vitreous hu-

scured; the field of the pupil should be p-
when that instrument is employed. The loss
portion of vitreous humour does not essential
with the success of the operation; indeed, i
said, and perhaps justly, that the loss of a sr
is rather beneficial than otherwise. It woul
tremely dangerous experiment, however, to en
force out only a certain quantity. The loss
of this humour should not prevent the operato
pleting the operation in the best possible way
ing all the loose fragments of the opaque l
different portions of opaque membrane or cap

Another unfortunate circumstance whicl
happens, is the introduction of the cornea k
the lamellæ of the cornea; the consequence
be, that the section of the cornea will be ve
imperfect. There are various other circums
may interfere with the success of this oper
need not be detailed. Dexterity in perfo
be acquired by practice. Wenzel, perha

deliberate; close the eyelid; consider what is best to be done; and having made up his mind on that point, proceed with firmness and decision in the operation.

With respect to the after-treatment, the principal object will be, as far as possible, to prevent inflammation. A compress of fine linen or cambric, kept wet with cold water, should be applied to the eyes, or rather to the eye opposite that which has been operated upon; it should be fixed by means of a bandage, carried round the occiput, crossed in front, and pinned on the sides of the nightcap. The patient should be carried to bed after the operation; placed in the recumbent posture, with his head a little elevated, and the room should be darkened. He should be allowed nothing but barley-water, tea, or water-gruel, for the first few days; and if there should be any symptoms of inflammation, such as pain, a sensation as if there were some external body in the eye, accompanied with quickness of pulse, a quantity of blood should be immediately taken away from the arm.

It will be better not to disturb the bandage, or raise the lid to examine the eye, for at least three days, unless the patient should feel any considerable pain or irritation; for, in that case, it would be advisable to ascertain the cause by examining the eye. The patient should be kept in bed in the recumbent posture for five days, and not even be suffered to rise for the evacuation of his fæces; a bed-pan should be used for that purpose. At the end of that time he may get up to have his bed made. The best way of preventing irritation is carefully to avoid making any undue pressure on the globe of the eye.

Great care must be taken, in adjusting the bandage,

whether there are any such before the operati
should be any tendency to inversion of the
prevent the lid from rubbing against the su
globe by means of a bit of adhesive plaster fa
cheek. It has been already stated that to op
eye is sound, is not advisable; neither is it ri
should be a cataract in each eye, to operat
once, unless the patient should particularly d

SECTION 3. ON THE OPERATION FOR SOLUTION OF THE CATARACT

The third operation is that for procuring s
cataract, which is particularly adapted to
of children. This renders it necessary to m
servations on congenital cataract. Children
frequently either born with cataract, or with
to cataract, which speedily makes it appear
it is not common to find an absolute opaci
or of the capsule containing it, at the birth
[illegible] its appearance

Mr. Saunders, who has given particular attention to cataract in children, is the capsular. In general, he found the lens itself more or less absorbed, the anterior and posterior layers of the capsule being opaque and adhering. The appearance of the cataract is somewhat different from that in the adult; there is an opaque nucleus either at the centre or some part of the circumference, and the rest has an unequal opacity, or streaked reticulated appearance. Another circumstance peculiar to congenital cataract is the unsteadiness and constant motion of the eye, which it is not difficult to explain. The eye has never been accustomed to have its vision fixed by objects, unless, perhaps, very imperfectly, and consequently the will has never been in the habit of influencing the muscles which give direction to the globe of the eye. Hence its unsteady and constant motion.

It was formerly deemed advisable to defer the operation for cataract in children, but Mr. Saunders has introduced a mode of operating in these cases which may be resorted to at any age. This is certainly one of the greatest improvements which have been made in this branch of surgery, not only because vision is extremely important for the purposes of education, but because, if the operation be delayed, a very considerable time will elapse before the patient can acquire a command over the eye, in consequence of the want of voluntary influence over the muscles. Another and more forcible reason, why this operation should not be delayed, is, that it is an universal law in the economy of nature, that all parts which are not exercised lose more or less of power; and, consequently, the retina, from not being accustomed to receive

power of vision than was sufficient to
tinguish between light and darkness. The op
in general be performed with a hope of succ
the age of eighteen months and four years.
ders's mode of operating is not confined to
of children; it may be employed also in the
adults, provided they are fluid, soft, or membr
racts.

This operation is not entirely new; in
works, some instances are mentioned, where
a very similar operation. He tells you th
where the cataract was too soft for depressi
times lacerated the anterior layers of the cap
admit the aqueous humour and procure th
the cataract. Hey, Scarpa, and Ware, ha
similar operations. We are not, however
those as the inventors of any practice who
employed it here and there, without statin
rules for its general applicability.

It is to Mr. Saunders that we are indebt

operation is very simple; it consists merely in an opening in the anterior layer of the capsule of ı, breaking up more or less the texture of the cata- ł admitting the aqueous humour, in which the ca- s dissolved, and by this means absorbed. It may ɔ properly called an operation for the absorption, r the solution of the cataract, since absorption is mate object of it. The instrument required is a very similar to that employed in the operation for ıg ; the point, however, is somewhat different; its rs are made cutting. It will be right, before the ɔn, to use belladonna for the purpose of dilating ɔil, so that the cataract may be distinctly seen. A quantity of the extract of belladonna, softened to sistence of cream, may be introduced into the eye, ared round the lids.

perating on the adult, the patient should be placed same position as in the operation for couching; n are better placed in the recumbent posture, with ad fixed on a pillow. Sometimes a speculum is ɔd to steady the eye; Pellier's speculum is the best s purpose. The needle may be introduced either same way as in the operation for couching, or else h the cornea. In the latter case there are two of operating, called the anterior and the posterior. former, the needle is introduced at the distance of line from the junction of the cornea with the scle- carried parallel to the iris, and turned inwards, so ɔreak up a portion of the capsule of the lens. In sterior operation, the needle is carried through the *or chamber*, a little behind the iris, and the texture

the principal object must be, as all cases require, to prevent inflammation. It is better in this operation to attempt to do too much at once; but rather to do it frequently, than to break up the texture too much at once.

SECTION 4. GENERAL REMARKS ON THE OPERATION FOR CATARACT.

Having described these different operations, it is necessary to consider which of them it may be most expedient to adopt. It appears that in those cases which admit of the operation for solution, namely, in soft and most cases of membranous cataract, that operation is greatly preferable to any other. Soft, fluid cataract and membranous cataract cannot be depressed. It is true that the operation for extraction might be performed in these cases, but it will be considered that the operation for solution is much more easy, and that it does very little injury to the eye.

In firm cataracts, where it is a matter of doubt whether the operation for depression or extraction

cornea is very flat, and the anterior chamber necessarily small, or in cases of contraction of the pupil, myosis, or arcus senilis.

There are some cases in which the unsteadiness of the eye is so great, either from spasmodic motions to which the patient is subject, or from invincible fear or stupidity, that it will not be advisable to attempt the operation. These remarks are borne out by the case of a woman in St. Thomas's hospital, who had cataract in both eyes, and was operated on by Mr. Green. When the operation was proposed to her, she immediately consented; and, supposing that she would have sufficient resolution to go through with it, he sat down with perfect confidence to perform the operation for extraction. She no sooner, however, felt the pain—pain it can scarcely be called—the uneasiness rather, arising from the application of the instrument—than she could not keep her head at all steady, but threw herself into all sorts of postures. He succeeded however, but with great difficulty, in making a very indifferent section of the cornea, and in extracting the cataract from the eye. He was then induced to attempt the operation on the other eye; and if the patient was unsteady during the first operation, she was ten times more so during the second. The consequence was, that though he completed the section of the cornea in the second, he found he could not proceed without the risk of doing considerable injury to the part; and he thought it best to leave the cataract in its place.

Where there are no contra-indications to deter us from performing the operation for extraction, it is undoubtedly *the most effectual operation*, as it completely removes the

disease; but then it requires much more skill and dexterity than the operation of depression; and the want of sufficient skill is more likely to prove injurious to the patient. The operation for depression is extremely easy, but it has its disadvantages. Not unfrequently the cataract rises again, and it will be necessary to repeat the operation. If the cataract be depressed on the retina, the patient will experience constant pain, which sometimes terminates in amaurosis. It sometimes happens, after the operation for couching, that the patient is seized with vomiting, accompanied with acute pain. This has been supposed to be the consequence of wounding the ciliary nerves. Whether this opinion is well founded is doubtful, but it commonly happens, that when the operation is followed by vomiting, the cataract rises again.

No judicious surgeon will, indiscriminately, prefer one mode of operation to another; his opinion must be decided by the nature of each particular case. In general, where the nature of the cataract admits of it, the operation for solution is preferable. In cases where the operation for extraction is not contra-indicated, it will be preferable to that of depression, if the surgeon has had sufficient opportunities of acquiring dexterity; but if he has not been much in the habit of performing the operation, the operation for depression is the safer, though less effectual course.

SECTION 5. OPERATION FOR ARTIFICIAL PUPIL.

Where, from some defect of the cornea or iris, or the *parts connected* with them, there is no passage for the *rays of light*, the operation for artificial pupil is required,

which consists in making a section with a cutting needle through the iris, which, by the elasticity of its fibres, separates the edges, and makes a passage for the rays of light. Cheselden was the first surgeon who performed it. There are three modes of performing the operation:—1st, by a simple incision of the iris, technically called *corotomia;* 2dly, where a portion of the iris is cut away, which operation is called *corectomia;* 3dly, where the iris is turned away from its attachment to the ciliary ligament, which is called *coredialysis.*

The simple incision of the iris is seldom resorted to; the operation of excision of a part of the iris was recommended by Mr. Gibson, and is certainly the best when the case admits of it. Mr. Gibson's mode of performing it, is to make an incision with a knife, as near as possible to the iris, and then, making gentle pressure on the globe of the eye, so as to protrude the iris, to snip off a portion with a pair of scissors. If the iris was adherent, so that it could not be protruded, he hooked it forward with a little hook, and then snipped away a portion with the scissors.

The operation of separating a part of the iris from its attachment to the ciliary ligament may be performed with Scarpa's needle. The needle should be introduced on the outer side through the cornea, at the distance of two lines from its junction with the sclerotica, and carried across the anterior chamber parallel to the plane of the iris. The point is then to be directed through the iris towards the inner side, and then, carrying it backwards and outwards, the iris is to be detached from the ciliary ligament.

The excision of a portion of the iris is the preferable operation, but where the case does not admit of it, the

the operation to the circumstances of each part

CHAPTER VII.

AFFECTIONS OF THE EYEBA

SECTION I. ON FUNGUS HÆMATODES OF

THE first disease deserving of our attention i
hæmatodes of the eye, malignant fungus, or s
by some, medullary sarcoma, a disease which
fatal, unless an operation be early performe
then the chance of success is extremely doubt
appears exempt from this complaint, but
quently attacks the young; and a large prop
cases occurs before twelve years of age.

SYMPTOMS OF FUNGUS HÆMATODES OF

ance enlarges into a prominence, proceeding from the bottom of the eye towards the cornea, and as it reaches the lens, care must be taken that it is not mistaken for cataract. There is one appearance, however, at this stage, by which the one can be distinguished from the other; upon the opaque substance, or the retina, of which its covering consists, branches of the arteria centralis retinæ may be seen ramifying.

The other symptoms are loss of vision, and the iris remaining immoveable. As the prominence enlarges, the iris becomes protruded, and the cornea distended. The conjunctiva becomes inflamed, the eyelids vascular, and in a diseased state; and in process of time the cornea sloughs, an opening is formed, and a discharge of a ropy mucus first takes place.

The fungus does not always protrude through the cornea, but sometimes through the sclerotic, and then it has a purple, livid hue, and is covered by the conjunctiva. When the fungus increases in size, it assumes a dark red colour, its surface is unequal, and irregular; it bleeds at the slightest touch; the parts slough, and then there is a fetid, sanious discharge. During the progress of the complaint, the health becomes affected, the countenance puts on a sallow hue, and the patient wastes in flesh. This disease is accompanied, and generally preceded, by disorder of the digestive organs; the appetite is impaired; and there are present all the other marks of derangement of the general health. When the strength and health are broken up, the disease very soon comes to a termination. The close of the disease is preceded by hectic fever, as is that of most complaints from which the general

health has suffered much during their progress. In fungus of the eye, the rest is completely destroyed, there is an affection of the nervous system; and in children, convulsions come on, which terminate their existence. In all stages of the disease, there is a tendency to them, and they generally prove destructive to life.

If the appearances of the eye be examined, little difference will be found in them from those of fungus in any other part. There is a grumous appearance on the surface, and the fungus bears a striking resemblance to the medullary matter of the brain; not unlike cream to the sight. The appearances, however, vary in different forms of the complaint. No one texture of the eye is free from it. It frequently commences from the optic nerve, extends to the retina, sclerotic, and choroid coats; but, on examining a fungus of the eye, it would be difficult to say where it began, the disorganization is so complete; the retina is destroyed—the humours are absorbed—the choroid protrudes, and very little of the natural texture is left.

In some cases the greater part of the anterior chamber is filled with a dark substance, like the pigmentum nigrum. In some instances the disease extends along the optic nerve, which enlarges, becomes altered in texture—of a brown colour—and reaches the brain, which will also be affected by the disease. The only remedy in this disease is the extirpation of the eye, and this in the early stage. In most cases, the operation proves unsuccessful, in consequence of its not being performed sufficiently early, or *before there is a disposition in the constitution to reproduce the disease.*

SECTION 2. CANCER OF THE EYE.

By cancer of the eye is meant, not cancer of the globe of the eye, for it rarely or ever commences in it; but it begins in the appendages and conjunctiva, and then extends to the globe of the eye; its common seat is in the conjunctiva. Cancer of the eye at the onset resembles a warty tumour with an ulcer on its surface, which has exactly the same appearances as ulcers in other parts of the body; therefore it will not be necessary to describe them; it then extends not only to the globe of the eye, but to the palpebral lining, the lachrymal gland, the periosteum of the bones forming the orbit, and the antrum; in fact, the globe and its appendages become one entire mass of disease.

No good can be expected in the treatment of this complaint unless the cancer be early removed by the knife. In the progress of the disease the general health becomes broken up.

SECTION 3. MELANOSIS OF THE EYE.

The eye is sometimes affected with melanosis, when it is converted into a peculiar black texture, a substance of sooty blackness. Should this affection be confined to the globe of the eye; if the optic nerve is not involved in the disease; if there be no evidence of any internal organ being affected; it is, under these circumstances, advisable to give the patient a chance, by its removal. In many cases where it has been performed early, the operation has succeeded, and the life of the patient has been saved.

if the operation be not performed, the tendency of the complaint is to destroy life, and it will go on to its destruction.

SECTION 4. EXTIRPATION OF THE EYE.

Although this operation appears formidable, and is so to the patient, as it is a most painful one, yet it is not difficult of execution. The best mode of performing it is as follows :—The patient is to be placed in the sitting posture, or, at any rate, with the head elevated, and in order to steady the eye, or shift its position, if necessary, pass a needle, armed with a ligature, through the fore part of the globe of the eye, by which means it is easy to steady it, or move it from one side to the other. If the lids are contracted, or the eyeball is exceedingly large, it will be necessary to divide the outer angle, in order to facilitate the operation. An assistant raises the upper lid, and the operator then introduces a double-edged straight knife through the conjunctiva, and divides the cellular membrane as extensively as he can. He next cuts through the oblique muscles ; and having done this, he then divides the recti muscles and the optic nerve ; to complete this last step of the operation, a curved knife adapted for the purpose, is used, and the globe of the eye is thus easily extracted.

It seldom happens that any hemorrhage takes place which may not be stopped by dossils of lint. The lids are to be brought in apposition, a compress of linen is to be applied over the eye ; inflammation should be guarded against, and the patient should not be neglected ; for al-

though inflammation does not frequently supervene after the operation, yet it sometimes comes on, extends to the membranes of the brain, and proves fatal.

CHAPTER VIII.

ACCIDENTS TO THE EYE.

HAVING described the various affections of the eye, it remains now to notice certain accidents to which it is liable, such as the introduction of extraneous bodies, and wounds.

SECTION 1. REMOVAL OF EXTRANEOUS BODIES.

It is very common for various minute substances to pass between the eyelids, and to get in contact with the external surface of the globe, or to adhere to the internal surface of the eyelids; in both cases causing great pain and inconvenience by the mechanical friction produced by the various motions of the eye and eyelids. The situation of any extraneous body is immediately perceived, not only by direct sensation, but in consequence of the motion of the lids, which, by passing the part affected, increases the pain, and, if the foreign body be small and moveable, generally removes it from the surface of the eye, whilst, by its adhesion to the inside of the lid, it becomes a more constant source of irritation. The situation of the offending substance has great influence on the symptoms which follow. When the extraneous body is *lodged on that* part of the conjunctiva which lines the

cornea, is certain, unless ...
cases out of ten, the foreign body is lodge
per eyelid, and the symptoms come on mu
and severely, in consequence of its greate
tion. In order to remove the foreign
upper eyelid, which may be done in the fol
take the ciliary margin of the eyelid betw
and finger, draw the eyelid downwards an
from the eye, and with the end of a prob
against the upper part of the lid, then
margin backwards over the end of the p
the upper eyelid is everted, and the muco
on this surface the extraneous body
found, and may be removed by the po
If the foreign body be on the lower ey
tion will be attended with little difficul

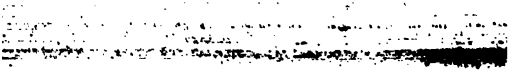
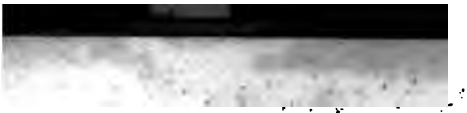
Extraneous bodies sometimes rest on
cornea, and produce nearly the same i
they were attached to the under surfac
lid, though not quite so great pain. If

patient into a good light, separate the lids with your fingers, and direct the patient to look attentively and steadily at any object before the eye, then, having a clear view of the extraneous body, insert the point of the cataract needle below it and raise it from its situation.

SECTION 2. PENETRATING WOUNDS OF THE EYE.

Penetrating wounds of the globe are attended with great risk of serious inflammation. Even in the operation for cataract, where the least possible violence is inflicted, most violent inflammation frequently ensues: it is not surprising therefore that wounds, the result of considerable violence with coarse blunt instruments, attended with lacerations and contusions, occasion most serious inflammation of the eye, in many instances attended with destruction of its function. In all these cases strict antiphlogistic treatment, perfect rest to the eye, rest to the body, and low diet, are indispensable: this is the constitutional treatment in all cases of wounds penetrating the cornea or sclerotic. The local treatment will of course vary with the case.

In these cases it sometimes happens that blood is effused into the chambers: the mere presence of blood, is in itself of little moment; because it will be absorbed; but its presence in the chambers of the eye, shows that an injury has been offered to the internal part which is likely to prove serious in other respects. It induces congestion of the retina, and impairs the function of the organ in the same manner as a violent blow on the head will impair the functions of the sensorium: so that a blow on the eye, by producing congestion of the retina, may be the

pupil however ge...
the artificial opening remains. Sometimes,
of the cornea and iris, displacement of the le
In such cases it is advisable to enlarge the
extract the lens, otherwise, it may produc
and inflammation of the eyeball. In some
protrudes; if it be uninjured, it may somet
to contract by the joint stimuli of light ar
this should fail, the protruded portion shou
by the scissors, so as to offer as little obsta
to cicatrization.

THE END.